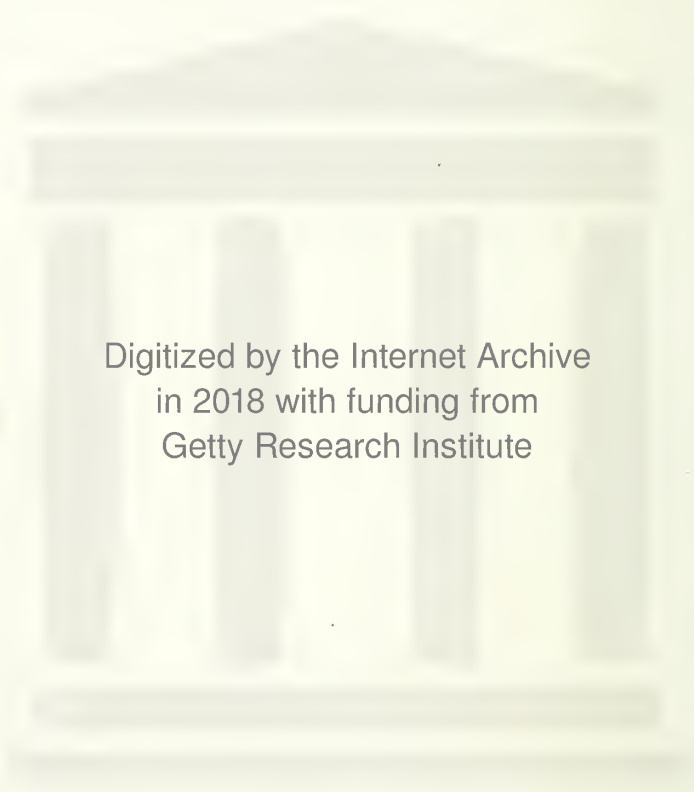




THE ART OF  
DOUBLE-COUNTING  
ON THE LATHE.



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VIII. II. 98

THE ART

OF

DOUBLE-COUNTING ON THE LATHE.

LONDON:  
G. BARCLAY, Printer, Castle St. Leicester Sq.

THE ART  
OF  
DOUBLE-COUNTING ON THE LATHE;

WHEREBY  
A VARIETY OF PATTERNS,

IN THE FORM OF  
ELLIPSES, TRIANGLES, SQUARES, PENTAGONS,  
HEXAGONS, AND OCTAGONS,  
3, 4, 6, AND 8-LOOPEO FIGURES,

BESIDES OTHERS OF A MORE COMPLEX CHARACTER,

MAY BE PRODUCED BY MEANS OF  
THE COMMON ECCENTRIC CHUCK,

USED IN COMBINATION WITH  
THE DIVISION-PLATE AND THE ECCENTRIC  
AND ELLIPTICAL CUTTERS.

WITH SIXTY ILLUSTRATIONS.

By CAPT. JAMES ASH,  
LATE BOMBAY ARTILLERY,  
INVENTOR OF THE ELLIPTICAL CUTTING-FRAME.

LONDON:  
L. BOOTH, 307 REGENT STREET;  
AND SOLD BY HOLTZAPFFEL AND CO., 64 CHARING CROSS.

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1857.

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# THE ART

OF

## DOUBLE-COUNTING ON THE LATHE.

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### PRELIMINARY OBSERVATIONS.

SOME years ago I obtained a copy of Mr. Ibbetson's work on the Double Eccentric Chuck which he had invented, and while studying the construction of that instrument, it struck me that a large number of the patterns which it produced could be performed with the common (or single) *Eccentric Chuck*, if the *Eccentric Cutter* were used instead of the *fixed tool*, and if the *Division-plate* of the lathe and the wheel of the *Eccentric Chuck* were *counted together*, in a fixed ratio for each cut; while the *eccentricity*, and the *position* of the cutter-tool, were obtained on the *Eccentric Chuck*, and the *Slide-rest*.

In order to carry out this idea, I procured a flat brass ring, divided into 96 divisions (that being the number of divisions on my Eccentric Chuck-wheel), and fixed it temporarily *over* the brass *Division-plate*

of my Lathe; and I soon found that, by obtaining the required eccentricity on the Eccentric Chuck, the required position of the Cutter-tool on the Slide-rest, and by counting both on the Division-plate, and on the Eccentric Chuck-wheel, in certain ratios for each cut, I could produce a variety of patterns in the form of ellipses, triangles, squares, pentagons, hexagons, and octagons.

As minute explanations of every part of the process will be given in the body of the work, it will be enough to observe here, that the adjustments of the Eccentric Chuck and Slide-rest, when once made, never require to be again altered while the pattern is being cut; and *after* these adjustments *have* been made, nothing requires to be done but to count *double* for each cut.

Thus, suppose, for example, you begin an elliptical pattern, with the adjusting index, or stop, at 96 on the *division plate*, and detent at 96 on the Eccentric Chuck-wheel, the counting for the six first cuts would be as follows:—

Set Division-plate at 96, set Ecc. Chuck-wheel at 96, and cut 1

|   |     |   |   |                   |
|---|-----|---|---|-------------------|
| „ | 2,  | „ | „ | 1, and cut again  |
| „ | 4,  | „ | „ | 2, and cut again  |
| „ | 6,  | „ | „ | 3, and cut again  |
| „ | 8,  | „ | „ | 4, and cut again  |
| „ | 10, | „ | „ | 5, and cut again. |

And so on, counting 2 on the Division-plate, and 1 on the Eccentric Chuck-wheel, *for each cut*, until you have cut entirely round the 96 divisions of the Eccentric Chuck-wheel, when the pattern will be completed.

In this instance, the Division-plate will go *twice*

round in one direction while the Eccentric Chuck-wheel goes once round in a contrary direction ; a ratio of two to one, which produces an elliptical pattern.

I may here remark, that in cutting all the following patterns, it is *invariably* the Eccentric Chuck-wheel which is moved forward only *one* division each time, while the proper ratio is kept up by moving the Division-plate two or more divisions each time, according to the form of the pattern which is being cut.

I had cut a good many specimens of this new method of turning, when I found I had to overcome a difficulty of no small moment. I have already said that I had fixed a brass plate, divided into 96 equal parts, *on* my Division-plate, as a temporary measure ; and I now had to determine on making a permanent Division-plate, suited not only for double-counting, but also for ordinary patterns, in order to avoid the constant trouble of shifting the temporary plate off and on.

My original Division-plate had one circle divided into 180 equal parts, and another into 120 ; and, as it was not large enough to carry another circle of 96 without crowding,\* I determined, after some consideration, to make a new Division-plate, with two graduated circles—one of 192 (or *twice* 96) equal parts, and the other as before, of 120.

The 192 circle, while fully equal to supplying the place of the former one of 180 for all common

\* The 3d circle would be too far from the edge of the Division-plate to allow the adjusting Index, or Stop, to work in it with ease, and truth.

patterns, is equally fitted for double-counting, by simply *doubling* the ratio required for a circle of 96 divisions. Thus, for an elliptical pattern, instead of counting 2 to 1, as we should do if both the wheels were equally divided into 96 divisions, we count 4 to 1, and so on with the higher ratios ; and I can safely say, that, after long use, I have never had reason to regret this mode of graduating my Division-plate, which I here recommend to all my readers, as nearly the whole of the patterns in this pamphlet are written down as worked on a 192 Division-plate.\*

After my first attempts, some years passed away before I had an opportunity of again turning my attention to the subject ; but at length, in 1855-56, while trying the powers of my Elliptical Cutting Frame, after it had been improved by Mr. Perigal's new adjustment, and the wheels for cutting 4-looped figures ; I again resumed my investigations, and was enabled to reduce to a regular system the whole method of cutting ; not only the Elliptical and Polygonal figures already specified, but also the various looped figures which add so much beauty to the series, and which had now more than quadrupled in number, from my having the power of substituting the Elliptical Cutting Frame for the Eccentric Cutter, thereby obtaining a set of patterns unequalled in novelty and beauty, if we consider the cheap and simple mode of production.

Before closing these observations, I would beg of the reader not to be disheartened by the difficulties

\* The peculiar value of the 120 scale in double-counting for square and octagon patterns will be pointed out at a future time.

which may beset him in his earliest efforts. It is true that he may find the double-counting\* at first both difficult and tedious, but let him recollect that the art of "double-counting" opens to him a perfectly new power of the Eccentric Chuck ; and that, while many of the patterns are wholly new, nearly all the remainder were long considered unattainable, except by those who were fortunate enough to possess the most expensive apparatus.

I shall now present my readers with a list of the apparatus required for "double-counting," and it will be perceived that few who have been in the habit of eccentric turning will have to add much to their stock.

---

*List of Apparatus for Double-counting, as laid down  
in this Work.*

1. A *Division-plate*, graduated with one circle of 192 equal parts, and one circle of 120 equal parts. The 192 scale should be numbered at all the sixes and twelves, and marked at all the fours on one side, and at all the threes on the other side, with a small dot. The 120 scale should be numbered at all the fives and tens. (*Vide* Plate I. Fig. 1, for both.) *Note.* Your Division-plate should be screwed on to the pulley-wheel of the headstock in such a manner as to allow you to adjust the Eccentric Chuck *perfectly upright*, when the stop is in the 192 hole.

\* "Double-counting," *vide* Note I at end.

2. An adjusting Index, or Stop, complete.
  3. An *Eccentric Chuck*, with *ratchet wheel* and *detent*, the ratchet wheel having 96 teeth or divisions (and not with screw wheel and tangent screw, as sometimes constructed).
  4. A Slide-rest, with a gun-metal receptacle for holding revolving Cutter-frame; and an elevating screw, with capstan-head, for adjusting the tool to height of centre.
  5. A *Brass Standard*, for adjusting the cutter tool to height of centre. (*Vide* Note 2, and Plate I. Fig. 2.)
  6. An *Eccentric Cutting Frame*, with tools complete; and, if possible,
  7. An Elliptical Cutting Frame, with the improved adjustment as suggested by H. Perigal, Esq. (*Vide* Holtzapffel's "Catalogue.")
- 

*"All at Centre."*

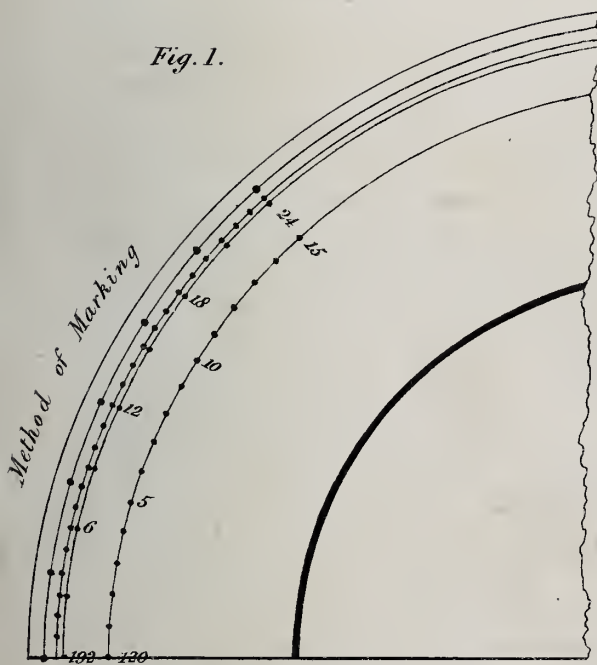
As the reader will find the words "All at centre" as a heading to almost all the rules laid down for cutting these patterns, I wish here to explain, once for all, the *meaning of the term*; and also to inform the reader that, even when not mentioned, the process here detailed should invariably be gone through. For, as these patterns are cut in exact ratios, and as the Eccentric Chuck-wheel has a most peculiar motion communicated to it during the cutting of the pattern, it is *essentially necessary* that *all the appa-*

# Plate I.

Fig. 2.

Brass  
Standard

Fig. 1.



Standard for a 5 Inch Lathe .

Bed of

Lathe .



*ratus used* should be adjusted with the *most minute accuracy* before you begin, and no pains should be spared to ensure the exact central position of the tool; and also, that the screws of the Eccentric Chuck and Cutting Frame be carefully adjusted to 0 on their respective screw-heads. I have, therefore, thrown together the following rules on all these points, which are *all* to be considered as included in the term, "All at centre."

1. Screw on the *Eccentric Chuck*, having the detent fixed at 96, and the piece of wood or ivory to be ornamented affixed in the usual manner.

2. Put on the *Slide-rest*, and *face* the wood as usual. After facing, either line, or polish the face according to fancy, using French polish, or hard lacquer, to bring the face of the wood to an exquisite polish, *care being taken* always to leave in the centre of the wood, or ivory, a very small pointed *knob*, standing out so as distinctly to show the exact centre of the wood, and no more.

3. Having *faced* and *polished* your wood, remove the Slide-rest; take off the catgut, and fix the *adjusting Index*, or *Stop*, in its place. Then set the Division-plate at 192, and having unfixed the binding screw of the Stop, take the small T-square, and placing the *blade across* the bed of the lathe, just *below* the Eccentric Chuck, set the handle up against the side-edge of the Eccentric Chuck, and adjust with the screw of the Stop, until the *Eccentric Chuck stands perfectly upright*; then clamp the binding screw of the Stop, and leave it so. *Note.* The same process is necessary when using the other scale. Set the Division-plate at 120, and proceed as above.

4. Now take the Slide-rest, and fix it on the bed of the Lathe, at some distance from its ultimate position in front of the wood, place the Eccentric Cutter in the *tool receptacle*, and clamp it tight, having seen that your Cutter-tool is *sharp*, and the screw of the Cutter set at 0. Now unclamp the binding screw of the Slide-rest, set the brass Standard on the bed of the Lathe, just in front of the Slide-rest, and, by means of the Capstan-head of the elevating screw of the Slide-rest, *adjust tool for height*; then clamp the brass screw of the Capstan-head, bring the Slide-rest up to the work, and square it with the T-square against the face of the wood, and clamp the Slide-rest screw. *Note.* The same rule applies when the Elliptical Cutting Frame is used.

5. The *Slide-rest* having been carefully squared and fixed in its proper position, turn the screw of the rest forward, until the Cutter-tool is brought *exactly* opposite the little pointed knob left in the centre of the wood. Then, with your finger turn the Cutter round, and watch whether the *point of the tool turns round true*, or whether it appears to describe a very small circle round the little knob. If it does not turn *perfectly true*, turn the screw-head of the Cutter backwards, or forwards, from 0 until the tool cuts true, and then adjust again with the screw of the Slide-rest, until the greatest accuracy is obtained—that is, until the point of the tool rotates truly at the point of the little knob. *Note.* The *usual* error lies in the point of the tool being left a little more on one side than the other after sharpening. It seldom amounts to more than half a division on the Cutter

screw-head ; but even this slight difference should be allowed for when the Cutter-tool is turned out to cut the pattern. Thus, should the tool have to be turned out  $1\frac{1}{2}$  turns, you should take half a division either under or over that quantity, according as the error appeared beyond, or short of 0 on the Cutter screw-head.

6. See that your Cutter-screw, and the screw of the Slide-rest, and also the screw of the Eccentric Chuck, are not only properly adjusted as above, but also that they are all ready to move *forward* without "loss of time,"\* or all your labour will have been thrown away.

Now—

Your wood being *faced*, and *lined*, or *polished* ;

Your Division-plate being *stopped* at 192 ;

Your Eccentric Chuck set at 96, and *squared* till perfectly upright ;

Your Slide-rest perfectly square to the wood ;

Your Cutter-tool first adjusted to height and then adjusted to centre ; and

Your adjustments being all at 0, and ready to move "forward" without "loss of time ;"

you can put on your over-head catguts, and report yourself "All at centre," and ready to take your first lesson in double-counting.

### *First Trial for an Ellipse.*

I shall now show the reader how to convert a *circular* pattern into an elliptical one, by simply

\* "Loss of time," *vide* Note 3.

throwing forward the Eccentric Chuck, and then counting double ; or, in other words, counting on the Division-plate as well as on the Eccentric Chuck-wheel, instead of counting on the Eccentric Chuck-wheel *alone*.

I shall show this by *first* cutting *half* a circle in the usual manner, and then by converting the other *half* of the circle into an ellipse by simply giving eccentricity to the Eccentric Chuck, and by double-counting.

First, then, to cut the semicircle.

“ All at centre.”

|          |  |                     |
|----------|--|---------------------|
| Scale, } |  | { Instrument,       |
| 192 ; }  |  | { Eccentric Cutter. |

1. Turn forward the Slide-rest 8 whole turns.
2. Turn forward Cutter 8\* divisions to cut a small circle.
3. Set† Division-plate at 144 and Eccentric Chuck-wheel at 96.
4. Cut 49 cuts, counting *one* division for each on Eccentric Chuck-wheel, beginning at 96 and moving one division for each cut till you come to 48, which will produce the semicircle (Fig. 1).
5. Turn to 72 on Eccentric Chuck-wheel and cut a circle, which will mark the exact place of the middle cut of the other half of the circle.

Now, to cut the half-ellipse, proceed as follows :—

1. Set Eccentric Chuck-wheel again at 96, so that

\* “ Turn forward cutter 8 divisions,” *vide* Note 4.

† “ Set division-plate,” &c., *vide* Note 5.

*Fig. 1.*

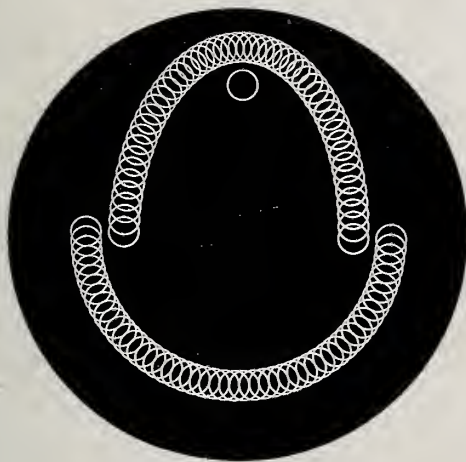
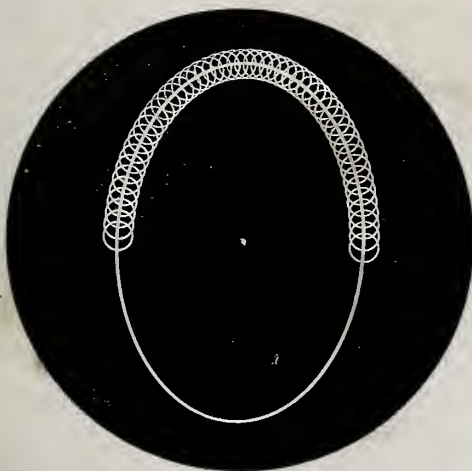


*Fig. 2.*





the Lathe will again stand at Division-plate 144, Eccentric Chuck-wheel 96.

2. Leave the Slide-rest *exactly where it is*, but turn the Eccentric Chuck *forwards, two whole turns*, and cut a circle; and,

3. For each subsequent cut have recourse to double-counting; or counting 4 divisions on the Division-plate and one division on the Eccentric Chuck-wheel for each cut. Thus the first seven cuts will be as follows:—

| Division Plate (or D.P.). |       | Eccentric Chuck-wheel (or E.C.W.). |    |
|---------------------------|-------|------------------------------------|----|
| 1st cut 144               | ..... | and .....                          | 96 |
| 2nd cut 148               | ..... | and .....                          | 1  |
| 3rd cut 152               | ..... | and .....                          | 2  |
| 4th cut 156               | ..... | and .....                          | 3  |
| 5th cut 160               | ..... | and .....                          | 4  |
| 6th cut 164               | ..... | and .....                          | 5  |
| 7th cut 168               | ..... | and .....                          | 6  |

And so on until you come to 144—48, when the half-ellipse will be complete.

---

### *Test of the Truth of the above Ellipse.*

In order to prove that this system of *double-counting* is capable of producing a *true ellipse*, I tried the following experiment:—

I first cut a large ellipse with the Elliptical Cutting Frame, and then exchanging the Elliptical Cutting Frame for the Eccentric Cutter, I cut over again one-half of the ellipse, with a half-ellipse of small circles generated wholly by the Eccentric Chuck and Double-counting; and an examination of Fig. 2 will show how mathematically true the system is.

1st. To cut ellipse with Elliptical Cutting Frame.

“All at centre” *most* carefully.

Set Lathe, Division-plate 144—Ecc. Chuck-wheel 96.

Then Elliptical Cutting Frame.

Flange ..... 15 divisions forward.

Cutter ..... 8 whole *turns* forward.

Adjustment 15 divisions forward.

Cut ellipse.

2nd. To cut half-ellipse in circles over the ellipse already cut.

Take out Elliptical Cutting Frame, and put in Eccentric Cutter, and *adjust height of tool by Standard.*

“All at centre” carefully.

2d. See that D. Plate is at 144 and E.C.W. at 96.

3d. Turn forward Slide-rest 8 whole turns.

4th. Turn forward Eccentric Chuck  $1\frac{1}{2}$  turns (or 15 divisions), and adjust (*see Note*).

5th. Turn out Cutter 8 divisions.

Cut one circle, and for each of the succeeding circles count 4 divisions on Division-plate and 1 division on E.C.W. for each cut till you come to 144—48, and you will find that the circles will exactly follow the curve of the first-cut ellipse.

*Note.* I say “*adjust*,” because if your Cutter-tool has not been set *exactly* in the centre of the wood, it will not (when turned *edge up*) exactly enter into the line already cut; therefore adjust by moving Slide-rest screw a little backwards or forwards until the *fit* is exact: the Eccentric Chuck can require no adjustment.

*On the Position of the Principal Cuts.*

As in inventing patterns, and for many other purposes, it is often useful to know "*the value in counting*," and the *position* of the principal cuts in an ellipse, generated by double-counting, I here present to the reader a figure (Fig. 3) of the positions of the 8 principal cuts in the ellipse (with the *value of each in counting*) below. It was worked out as follows :—

I took another piece of wood, and cut upon it an ellipse, using all the precautions I employed before, and having the Lathe fixed at D.P. 144, E.C.W. 96, I then took out the Elliptical Cutting Frame, and having substituted the Eccentric Cutter, I proceeded as follows :—

"All at centre."

Lathe, D.P. 144—E.C.W. 96.

Slide-rest 8 turns forward.

Eccentric Chuck  $1\frac{1}{2}$  turns (or 15 divisions).

And Cutter (turned edge up) adjusted to enter ellipse, then Cutter-screw turned forward 8 divisions.

Cut one at D.P. 144, E.C.W. 96, and for each subsequent cut count 48 divisions on Division-plate and 12 divisions on Eccentric Chuck-wheel—all round, in all eight cuts—which will follow each other as shown in this table :—

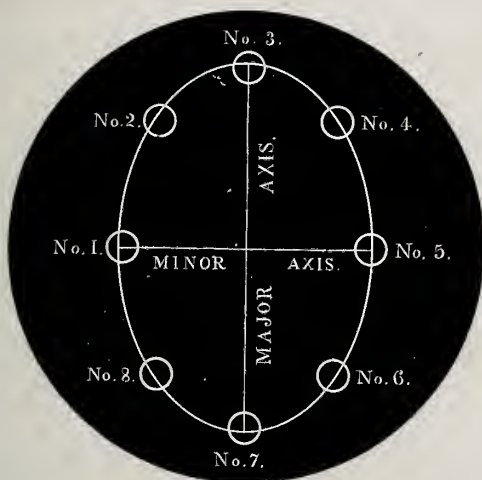
|           | D.P. | E.C.W. |                          |
|-----------|------|--------|--------------------------|
| Cut No. 1 | 144  | 96     | left end of minor axis.  |
| 2         | 192  | 12     | shoulder.                |
| 3         | 48   | 24     | one end of major axis.   |
| 4         | 96   | 36     | shoulder.                |
| 5         | 144  | 48     | right end of minor axis. |
| 6         | 192  | 60     | shoulder.                |
| 7         | 48   | 72     | other end of major axis. |
| 8         | 96   | 84     | shoulder.                |

From this example it appears, that when the Slide-rest is moved forward *more* than the Eccentric Chuck, the pattern (*i.e.* the first-cut) begins on the *left* of the wood (as you face it) and moves round to the *right*, as shown by the *arrow*, or even by the regular succession of the figures from left to right.

In this instance the Slide-rest was moved forward 8 turns, and the Eccentric Chuck only  $1\frac{1}{2}$  turns ; and this rule holds good as long as the Slide-rest is moved forward *more* than the Eccentric Chuck. This is worth knowing and remembering, as we shall find before long, that when the Eccentric Chuck is turned forward *more* than the Slide-rest, exactly the reverse takes place, the first-cut beginning on the *right* of the wood, and working round to the left. Again, we find that the first cut is at the left end of the minor axis, and that the ellipse, when finished, and the Lathe set at 144—96, is *perfectly upright*. Further, we find that at 48—24 we are at the *end* of the major axis ; hence, when inventing a pattern, we have only to turn to 48—24, and we find at once whether the wood is large enough for the pattern, or how near the edge this cut will come, which are both points of importance. Besides these, there are one or two other points of value, which will be noticed as they occur in the progress of the work ; and we shall now proceed to give a series of patterns of ellipses, and others belonging to the ratio of 2 to 1.

---

*Fig. 3.*



*Pattern 4.*





## PATTERN 4.

*Ellipse Cut within Ellipse, 1st Rule for the same given.*

1st Outer Ellipse.

“ All at centre.”

---

Scale, }  
192 ; }

{ Instrument,  
{ Eccentric Cutter.

Then, Slide-rest ..... 8 (eight) turns forward.

Eccentric Chuck 1 (one) turn forward.

Cutter ..... 8 (eight) *divisions* forward.

Set lathe at D. Plate 144, and E.C. Wheel at 96.

Cut 1 circle and then cut all round, counting for each cut 4 (four) on the Division-plate, and 1 (one) on the Eccentric Chuck-wheel, until you have completed 96 cuts, and the ellipse is finished.

2d Inner Ellipse.

---

Sharpen your cutter tool.

---

Set Lathe again at 144—96.

Then, turn out Cutter 1 (one) whole turn more.

And, turn Slide-rest *backwards*, until on turning round the Cutter with your finger you find a blank space left between the outer and inner ellipse of about the one-tenth of an inch.

The Eccentric Chuck is to be left *exactly as it was* in cutting the outer ellipse.

Then cut one circle at 144—96, and then cut all round, counting 4 (four) divisions on Division-plate,

and 1 (one) on Eccentric Chuck-wheel, for each cut, until you have completed 96 cuts, and the ellipse is finished.

*Note.* This first rule for cutting ellipse within ellipse is the same, even when more than two ellipses are required; indeed it holds good in all cases where the Slide-rest has been moved forward *more* than the Eccentric Chuck.

Thus, whenever you have cut one ellipse and require to cut another concentric ellipse, either within or beyond it, you only need to move the Slide-rest backwards or forwards, leaving the Eccentric Chuck just as it was when you cut the first ellipse.

In the present instance the Slide-rest was turned forward 8 (eight) turns, while the Eccentric Chuck was only turned forward 1 (one) turn; hence, in cutting the inner ellipse nothing was required but to turn back the Slide-rest. And now, having completed the inner ellipse, if I required to surround the *outer* ellipse with a set of very small circles, I should only have to set the Cutter-tool to a very small circle, and then turn *forward* the Slide-rest, until (with the Lathe at 144—96) the cutter would cut the little circle clear of the outside of the original ellipse (as in the quarter ellipse of little circles in Pattern 4, which, by the by, in printing the block, have been transferred from the left of the pattern to the right).

*Note.* The wood or ivory for these patterns should not *be lined*, but brought to a very fine surface, and beautifully polished, as it is clear that a set of minute concentric circles (as in lining) would but ill-accord with these ellipses.

---

## PATTERN 5.

*Ellipse, Cut with Elliptical Cutter (Horizontal).*

In cutting this pattern the instrument employed is the Elliptical Cutting Frame, instead of the Eccentric Cutter, and the Ellipse (of the Cutting Frame) is laid horizontal by means of the Adjustment.

“All at Centre.”

|          |                             |
|----------|-----------------------------|
| Scale, { | { Instrument,               |
| 192; }   | { Elliptical Cutting Frame. |

Then, Flange ..... 5 (five) divisions forward.

Cutter ..... 3 (three) whole turns forward.

Adjustment 38 (thirty-eight) turns, 3 (three) divisions forward.

That is, 37·2 to make the ellipse horizontal, and 1·1 due for Adjustment to 5 divisions set on Flange.

Total, 38·3.

Then, Eccentric Chuck 1 (one) turn forward.

Slide-rest ..... 6 (six) turns forward.

Set Lathe at 144—96, and cut all round at 4 to 1.

Now, let the reader try to cut the following, *without* the aid of a printed pattern (wood same size as last).

*Ellipse Cut with Eccentric Cutter.*


---

“All at Centre.”

|          |                     |
|----------|---------------------|
| Scale, { | { Instrument,       |
| 192 ; }  | { Eccentric Cutter. |

Then, Eccentric Chuck 1 (one) turn forward.

Cutter ..... 3 (three) whole turns forward.

Slide-rest ..... 4 (four) turns, 6 (six) divisions forward.

Set Lathe at D.P. 144, E.C.W. 96, and cut all round at 4 to 1, until 96 cuts have been executed, and the ellipse is completed.

*Note.* This pattern should appear *something* like No. 5, only smaller.

---

PATTERN 6.

*Ellipse (cut with Elliptical Cutter perpendicular) with Circle inside, and very small double Sea-Hedgehog inside all.*

---

“All at Centre.”

|          |                             |
|----------|-----------------------------|
| Scale, { | { Instrument,               |
| 192 ; }  | { Elliptical Cutting Frame. |

Flange ..... 3 (three) divisions.

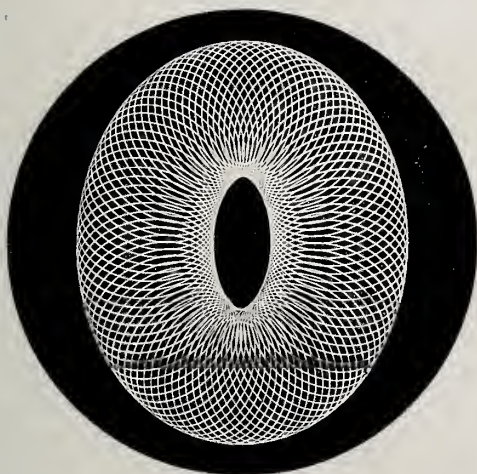
Cutter ..... 2 (two) whole turns.

Adjustment ..... 3 (three) divisions.

Then, Eccentric Chuck 1 (one) turn forward.

Slide-rest ..... 8 (eight) turns forward.

*Pattern 5.*



*Pattern 6.*





Set Division-plate at 144, and Eccentric Chuck-wheel at 96, and cut D.P. 4 to E.C.W. 1, each cut all round until ellipse is complete.

Now take out Elliptical Cutting Frame, and put in Eccentric Cutter and sharp tool.

Then for circle inside,—

“All at Centre.”

---

|          |                                |                |
|----------|--------------------------------|----------------|
| Scale, } | <i>Mind the height of tool</i> | { Instrument.  |
| 192 ; }  | <i>by Standard.</i>            | { Ecc. Cutter. |

Set Cutter forward 8 (eight) divisions, set Lathe at 144—96.

Turn Slide-rest forward until Cutter, when turned round, just touches inside edge of ellipse, and cut all round, by counting 1 (one) division each cut on the Eccentric Chuck-wheel alone, as this is not a case of double-counting. The way of producing “the very small double Sea-Hedgehog inside all” will be explained hereafter.

*Note.* In these ellipses, cut with “Elliptical Cutter perpendicular,” you should, as a rule, always use a *very full* ellipse; for if (as I once did) you use a very long or narrow ellipse, the shoulders of the large ellipse become thicker than the rest of the pattern, and the effect is far from pleasant. But if you use a full ellipse, the pattern is of the same width throughout; and if the cuts are deep (or well cut up) the effect is most rich and beautiful. In this ellipse you see I have only Flange 3 (three) divisions to Cutter 2 (two) whole turns.

## PATTERN 7.

*Solid Ellipse with Shell Border.*

This pattern is cut with a *thick* and *thin stroke*, which is in many instances very effective. I shall, therefore, give minute directions for its due performance, which the reader can apply to other patterns, according to fancy.

“All at Centre.”

---

Scale, }  
192 ; }

{ Instrument,  
{ Eccentric Cutter.

Eccentric Chuck  $1\frac{1}{4}$  (one & a quarter) turns forward.  
Eccentric Cutter 3 (three) turns forward.

Set Lathe at 144—96.

Then turn forward Slide-rest until the Cutter would just cut a circle beyond centre of the wood ; then make a slight mark on the wood with the Cutter-tool, on the left or outside edge of the circle which it would cut ; then unscrew the clamping-screw of the Slide-rest, and throw *back* the right of the Slide-rest a trifle, so that the cut when made would be deep and thick on one side, and would be fine and thin on the other side. This throwing back of the right of the Slide-rest is best done by putting the **T**-square in its place on the ledge of the Slide-rest, and quietly pressing back the right of the Slide-rest until the **T**-square forms a very slight angle with the face of the wood ; touching it on the left, and about one-tenth of an inch away from it on the right

*Pattern 7.*



*Pattern 8.*





(a trial or two will soon give you the right angle). Then clamp the screw again, and turn forward the Slide-rest until the Cutter-tool again cuts in the *mark* you formerly made; then set your screws to cut a thick and thin circle, and cut all round at 4 to 1, until you have completed 96 cuts, when the solid ellipse will be finished. (For thick and thin cuts, *vide* Note 6 at end.)

### *Border.*

Unclamp, and set Slide-rest square to wood with  
T-square.

Set Cutter at 1, turn 6 (six) divisions.

Set Lathe at 144—96, and turn out Slide-rest, until Cutter will cut a circle a little way beyond the edge of the solid ellipse. Then cut circles at all the 12's on the Division-plate, and all the 3's on Eccentric Chuck-wheel. Thus—cut at 144—96, and at 156—3, and at 168—6, and at 180—9, and at 192—12, and so on till 32 circles are completed. Then turn *back* 2 divisions on Cutter (mind loss of time), and turn Slide-rest 2 divisions *forward*, and cut round again, and so on, according to fancy. In working mine I took 4 cuts, reducing size of circle as above. I then took blind cuts (counting each time on Cutter and Slide-rest), till I had reduced the cut to a very small circle touching the other side, when I cut all round again.

*Note.* In cutting these shell patterns, always set Lathe again at 144—96, before you alter Cutter and Slide-rest, or you will chance to omit some of the cuts.

## PATTERN 8.

*Variegated Ellipse, with Elliptical Shell Border.*

“All at Centre.”

|         |  |                     |
|---------|--|---------------------|
| Scale,} |  | { Instrument,       |
| 192 ;}  |  | { Eccentric Cutter. |

Then, Eccentric Chuck 1 (one) turn forward.

Cutter ..... 2 (two) whole turns forward.

Slide-rest .....  $4\frac{1}{2}$  (four and a half) turns forward.

Set Lathe at D.P. 136—E.C.W. 94 ; and cut all round, as laid down in Table A. (Note 7, at end of work.)

*Border.*

|         |  |                             |
|---------|--|-----------------------------|
| Scale,} |  | { Instrument,               |
| 192 ;}  |  | { Elliptical Cutting Frame. |

Leave Eccentric Chuck as it is.

Unfasten Slide-rest—take out Eccentric Cutter—put in Elliptical Cutting Frame ; and mind, as soon as the Elliptical Cutting Frame is fixed in Slide-rest, to put in a fresh sharp tool, *and to adjust height of tool by standard*. Then set Slide-rest in its position in front of the wood, and square it carefully with T-square ; but never mind adjusting tool to centre knob of wood, as it is not required.

Then, Flange..... 5 (five) divisions.

Cutter..... 2 (two) turns, 4 (four) divisions.

Adjustment 38 (thirty-eight) turns, 3 (three) divisions (or  $37\cdot2$  for horizontal + 5 divisions for Adjustment to Flange).

Set Lathe at 144—96, and turn forward the Slide-rest till the Cutter, on being turned round by hand, would just cut clear of edge of centre pattern ; then turn forward Slide-rest 8 (eight) divisions *more*, so as to leave a blank space between centre pattern and border. (Prepare for "*loss of time*," as we shall soon have to turn *back* both Cutter and Slide-rest.)

Then cut one cut at 144—96, and then cut all round at ratio of 12 to 3, or for each cut count 12 on D.P., and 3 on E.C.W. Thus, cut at 144—96, at 156—3, at 168—6, at 180—9, at 192—12, and so on, until 32 cuts are completed. Then set Lathe again at 144—96. Turn *back* Cutter 4 (four) divisions, and Slide-rest 4 (four) divisions, and cut all round as before. Then turn back Slide-rest and Cutter 3 (*three*) divisions each, and cut all round again.

Then turn back Slide-rest and Cutter 2 (*two*) divisions each, and cut round again, taking care to set Lathe at 144—96 each time. Now take out Elliptical Cutting Frame, and put in Eccentric Cutter. Adjust height of tool by standard ; square Slide-rest carefully to face of wood ; set Lathe at 144—96 ; set Cutter forward 2 (two) divisions, to cut a very small circle ; turn forward Slide-rest, and adjust to spot, as in pattern, and cut all round again as before 12 to 3, and the pattern is finished.

*Note.* These small circles *could* be cut with the Elliptical Cutter ; but it is best on all occasions to spare that instrument as much as possible.

---

## PATTERN 9.

*Ellipse in Straight Lines, with Elliptical Shell  
Border. Perpendicular.*

“All at Centre.”

|          |                             |
|----------|-----------------------------|
| Scale, { | { Instrument,               |
| 192 ; }  | { Elliptical Cutting Frame. |

Then, Eccentric Chuck 1 (one) turn forward.

Slide-rest..... 6 (six) turns forward.

Then, Flange..... 10 divisions.

Cutter ..... 10 divisions (or one turn).

Adjustment 40 (forty) turns (or 37 turns  
2 divisions for horizontal + 10 divisions, or 2 turns  
2 divisions for Adjustment = 40 turns).

Set Lathe at 144—96 ; and cut all round at  
4 to 1, until 96 cuts are completed.\* (*Vide* Note 8  
at end.)

*Border.*

Reduce Elliptical Cutting Frame to 0 in *all* its  
adjustments. Then set it as follows, to cut perpen-  
dicular pattern,—

Flange ..... 5 (five) divisions.

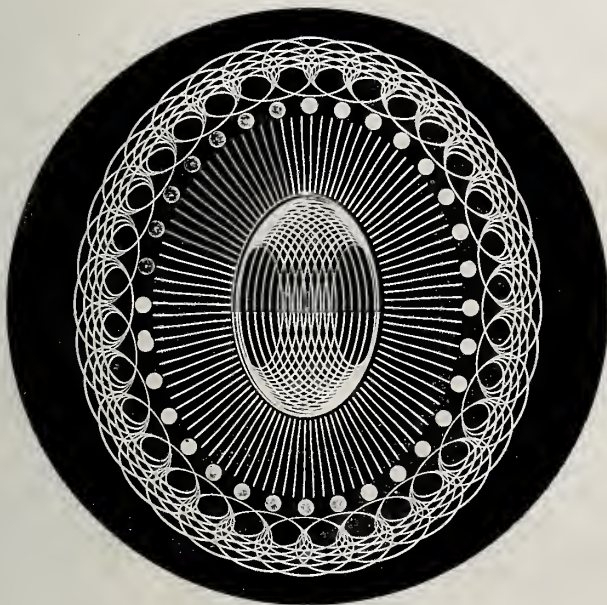
Cutter ..... 2 (two) whole turns.

Adjustment 5 (five) divisions (for upright).

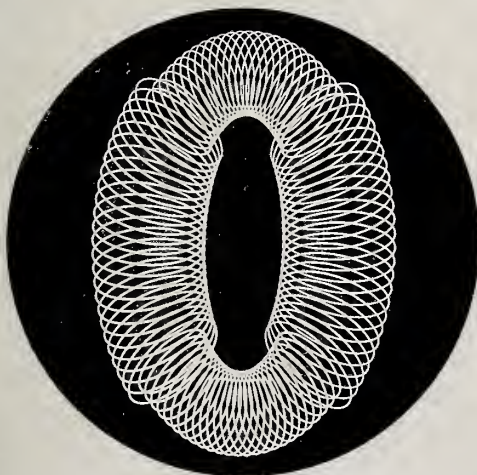
Set Lathe at 144—96.

\* Those who have an Universal Cutting Frame could cut  
these patterns with it, and the effect would be most beautiful.

*Pattern 9.*



*Pattern 10.*





Turn forward Slide-rest until the ellipse (if Cutter were turned round by hand) would touch outside edge of straight-line pattern; then turn Slide-rest forward 12 (twelve) divisions (or 1 turn and 2 divisions), so as to leave a blank space between centre pattern and border, and leave it so. Then with the Cutter-tool make a mark where the left or outside edge of the ellipse would be, and adjust Slide-rest for cutting thick and thin, as laid down in Pattern 7; and having clamped Slide-rest, cut all round at a ratio of 12 divisions on Division-plate to 3 divisions on Eccentric Chuck-wheel (as in last pattern), until 32 ellipses are cut. Then, taking precautions against "loss of time," turn back 3 (three) divisions on Cutter, and 3 (three) divisions on Slide-rest, and cut all round as before.

Now turn back 2 (two) divisions each on Cutter and Slide-rest, and cut all round as before.

Again, turn back 2 (two) divisions each on Cutter and Slide-rest, and cut all round again, and your outside pattern is finished.

Now, to cut the Double Elliptical Shell in centre, proceed as follows (but bear in mind that this is not double-counting),—

Square Slide-rest with **T**-square, and then

"All at Centre."

Then, Flange... 10 (ten) divisions (or equal to 1  
(one) turn on Ecc. Chuck).

Adjust... 10 divisions.

Then turn forward Cutter-screw till tool nearly reaches *inner* edge of straight-line ellipse, cut faintly,

and then turn to 48 on E.C.W., and cut faintly again.\* Now examine the lines, and adjust Slide-rest if necessary ; and then, when quite correct, give full depth to cut.

Then (mind loss of time) turn *back* Cutter 2 (two) divisions, turn *back* Slide-rest 2 (two) divisions, and cut again—first at E.C.W. 96, then at 48.

And thus diminish Cutter 2 divisions, turn back Slide-rest 2 divisions, and cut at 96 and 48 as often as you please.

### *To cut the Dots.*

Take out Elliptical Cutter ; put in Eccentric Cutter, with a flat-ended tool ; adjust tool to height by standard ; set Cutter to cut a dot.

Set Lathe at 144—96.

Turn out Slide-rest to blank space between ellipse and border ; adjust so as to cut dot fairly between both, and cut all round ; counting D.P. 12 to E.C.W. 3, and the pattern is finished.

*Note.* Perhaps it would look better to cut a brilliant dot with a single angle tool than a common dot with a flat tool.

---

\* By omitting this precaution my centre pattern is *not* in the centre, as the reader will perceive, so I wish to put him on his guard here. He may also look to the height of tool by this opportunity ; for if the faint line cut at 48 does not coincide in height with that cut at 96, a slight adjustment is necessary.

## PATTERN 10.

*Narrow Double-Horizontal Ellipses, one coming out of the other.*

“ All at Centre.”

|                                                                                  |                 |                                |
|----------------------------------------------------------------------------------|-----------------|--------------------------------|
| Scale, }                                                                         |                 | { Instrument,                  |
| 192 ; }                                                                          |                 | { Elliptical Cutting Frame.    |
| First, Flange.....                                                               | 8               | (eight) divisions.             |
| Cutter .....                                                                     | 2               | (two) whole turns.             |
| Adjustment                                                                       | $39\frac{1}{2}$ | (thirty-nine and a half) turns |
| (i.e. 37.2 for horizontal, and 8 divisions or 2 turns for Adjustment = $39.2$ .) |                 |                                |
| Then Ecc. Check                                                                  | 2               | (two) turns forward.           |
| Slide-rest..                                                                     | 7               | (seven) turns forward.         |

Now, if the reader will turn back to Fig. 3, he will perceive how I obtain all the counting which follows. I first set the Lathe at D.P. 96—E.C.W. 84, or at No. 8 of Fig. 3, and I double-count at 4 to 1 till I come to 192—12, or No. 2 of Fig. 3. I then move to 96—36, or No. 4 of Fig. 3, and double-count till I come to 192—60, or No. 6 of Fig. 3. I then turn back Flange and Cutter, so as to cut a smaller ellipse, and begin again where I left off at 192—60, and double-count round to 96—84, or No. 8 of Fig. 3, and then set Lathe at 192—12, or No. 2, and cut round to 96—36, or No. 4. We will now return to the pattern.

- 1st. Begin at 96—84 } and count 4 to 1 for each cut till you end  
 End at 192—12 } at 192—12.



Then, Eccentric Chuck 1 (one) turn forward.  
 Slide-rest ..... 9 (nine) turns forward.

Then cut as follows:—

|          |       |      |     |       |        |    |                 |
|----------|-------|------|-----|-------|--------|----|-----------------|
| Begin at | ..... | D.P. | 96  | ..... | E.C.W. | 84 | } count 4 to 1. |
| End at   | ..... |      | 192 | ..... |        | 12 |                 |
| Begin at | ..... |      | 96  | ..... |        | 36 | } count 4 to 1. |
| End at   | ..... |      | 192 | ..... |        | 60 |                 |

Now take care of “loss of time,” and

Turn back Flange..... 2 (two) divisions.  
 Cutter..... 5 (five) divisions.  
 Adjustment 2 (two) divisions.

Then (with Lathe at 192—60) turn back Slide-rest until inside edge of new ellipse touches inside edge of last ellipse (*vide* Pattern 11), then cut as follows:—

|               |       |      |     |       |        |    |           |
|---------------|-------|------|-----|-------|--------|----|-----------|
| 1st. Begin at | ..... | D.P. | 192 | ..... | E.C.W. | 60 | } 4 to 1. |
| End at        | ..... |      | 96  | ..... |        | 84 |           |
| 2d. Begin at  | ..... |      | 192 | ..... |        | 12 | } 4 to 1. |
| End at        | ..... |      | 96  | ..... |        | 36 |           |

Now for Centre.

*Note.* If you require to change your tool for a sharp one, take off your overhead catgut, and turn forward Slide-rest until the tool passes beyond the left edge of the wood, when the blunt tool can be removed and a sharper one substituted; or else, take Elliptical Cutting Frame out of the toolholder, and having put in a fresh one, replace it as before.

Then turn back “all to centre.” (*Vide* Note 9 at end.)

That is, Turn back Eccentric Chuck to 0.

Slide-rest to original centre.

(*Vide* Note.)

Elliptical Flange to 0.

Adjustment (which is at 39)  
to 0.

Cutter to 0.

Then turn forward Flange ..... 10 (ten) divisions.

Adjustment 10 (ten) divisions.

Set Lathe at 144—96, and turn forward Cutter until tool reaches inside of edge of your pattern, and if you find it, on trial, nearer one side than the other, adjust minutely with Slide-rest screw; and when *quite correct*, turn back Cutter to 0 (this settles the exact centre), and then turn Cutter forward exactly 10 (ten) divisions (or 1 (one) whole turn), which, as the Flange is already set at 10 (ten) divisions, will cut an upright straight line\* in the centre of the pattern; after which you may ornament the space between the straight line and the pattern with concentric ellipses, which you will obtain by simply turning out the Cutter 4 (four) or more divisions for each cut.

---

### *Sea-Hedgehog Patterns.*

In all the patterns I have hitherto introduced to the reader, the Slide-rest has been turned forward six or seven times *more* than the Eccentric Chuck; but in the following beautiful patterns, which I have

\* *Vide* Note 8.

called, for the sake of distinction, Sea-Hedgehogs or Porters' Knots, the Eccentric Chuck is turned forward *more* than the Slide-rest, and the Eccentric Cutter is then turned forward so that the tool passes some small distance beyond the little knob which marks the true centre of the wood.

This peculiar arrangement produces a corresponding change in the way in which the pattern comes out, for whereas, in the former patterns, the first cut was on the *left* of the wood, and the pattern gradually worked round to the *right*; these patterns begin on the *right* of the wood (as you face it), and work round from the *right* to the *left*.

I shall therefore begin by giving a figure of the 8 principal cuts, with a table of their position and value in counting.

The Adjustment required to produce Fig. 12 is as follows :—

Fig. 12.

“ All at Centre.”

|          |  |                     |
|----------|--|---------------------|
| Scale, { |  | { Instrument,       |
| 192 ; }  |  | { Eccentric Cutter. |

Eccentric Chuck 5 (five) turns forward.

Slide-rest.....  $2\frac{1}{2}$  (two and a half) turns forward.

Cutter ..... 4 (four) whole turns forward.

Set Lathe at 144—96, and cut one cut, and for every subsequent cut count 48 divisions on the Division-plate, and 12 on the Eccentric Chuck-wheel, as in this table :—

*Table of Position, and Value in Counting, of the 8 Principal Cuts in the Sea-Hedgehog Patterns.*

|                    | D.P.     | E.C.W. |                                  |
|--------------------|----------|--------|----------------------------------|
| 1st Cut, 144 ..... | 96 ..... |        | <i>Right side of minor axis.</i> |
| 2d Cut, 192 .....  | 12 ..... |        | Right upper shoulder.            |
| 3d Cut, 48 .....   | 24 ..... |        | Top of major axis.               |
| 4th Cut, 96 .....  | 36 ..... |        | Left upper shoulder.             |
| 5th Cut, 144 ..... | 48 ..... |        | Left side of minor axis.         |
| 6th Cut, 192 ..... | 60 ..... |        | Left lower shoulder.             |
| 7th Cut, 48 .....  | 72 ..... |        | Bottom of major axis.            |
| 8th Cut, 96 .....  | 84 ..... |        | Right lower shoulder.            |

The pattern thus begins on the right side and works over to the left. We are now ready to cut Pattern 13.

---

### PATTERN 13.

*Large Sea-Hedgehog (vide Note 10, at end).*

“All at Centre.”

---

|          |                     |
|----------|---------------------|
| Scale, } | { Instrument,       |
| 192 ; }  | { Eccentric Cutter. |

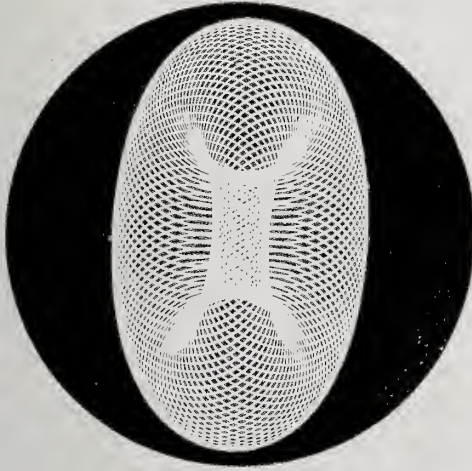
Eccentric Chuck 5 (five) turns forward.

Slide-rest.....  $2\frac{1}{2}$  (two & a half) turns forward.

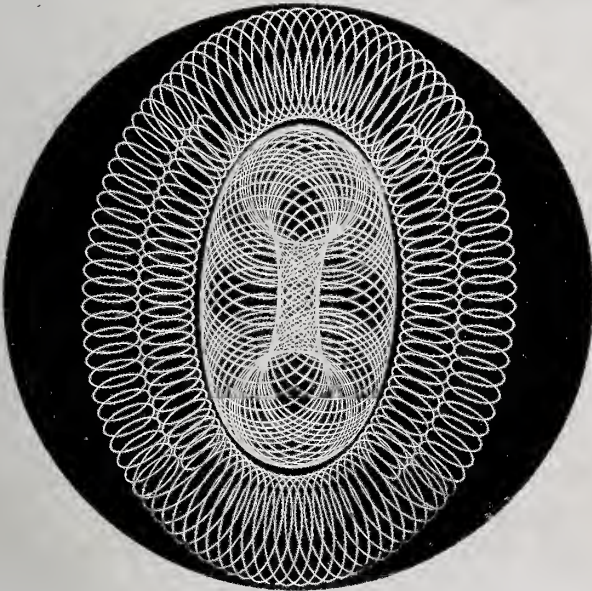
Cutter ..... 4 (four) whole turns forward.

Set Lathe at 144—96, and cut all round at 4 on Division-plate to 1 on Eccentric Chuck-wheel, till 96 cuts are completed, when the pattern will be finished.

*Pattern 13.*



*Pattern 14.*





## PATTERN 14.

*Variegated Sea-Hedgehog, with Border in Ellipses.*  
*Single row at top and bottom, and double rows at*  
*the sides. (Vide Note 11.)*

1st for the Sea-Hedgehog.

“All at centre.”

---

|          |                     |
|----------|---------------------|
| Scale, { | { Instrument,       |
| 192 ; }  | { Eccentric Cutter. |

Then, Eccentric Chuck 4 (four) turns forward.

Slide-rest ..... 2 (two) turns forward.

Cutter ..... 3 (three) turns forward.

Set Lathe at D.P. 136—E.C.W. 94, and cut all round by Table A. (*Vide* Note 7.)

Now for Border.

1st. Take out Eccentric Cutter and put in Elliptical Cutting Frame.

2d. Adjust height of tool by Standard.

3d. Square and fix Slide-rest in front of the wood.

“All at Centre.”

---

|          |                             |
|----------|-----------------------------|
| Scale, { | { Instrument,               |
| 192 ; }  | { Elliptical Cutting Frame. |

Then Eccentric Chuck 2 (two) turns forward.

Flange ..... 8 (eight) divisions forward.

Cutter ..... 2 (two) whole turns forward.

Horizontal Adjustment  $37.2 \div 8 = 39-2$ , thirty-nine turns; two divisions.

Then set Lathe at 144—96, and turn out Slide-rest until the Cutter would cut ellipse well beyond edge of pattern ; then set Lathe at 192—12, and try if ellipse is clear of centre-pattern ; if not, adjust by turning forward Slide-rest a little more ; if quite clear, proceed to cut border as follows, taking part by part :—

1st. Begin at 192—12 } count 4 to 1 each cut.  
End at 96—36 }

2d. Begin at 192—60 } count 4 to 1 each cut.  
End at 96—84 }

Now having done the two ends in single ellipses, proceed as follows :—

Turn *back* Flange ..... 4 (four) divisions.

Cutter ..... 1 (one) whole turn (mind  
loss of time).

Adjustment... 4 (four) divisions.

Then turn *back* Slide-rest till Cutter-tool exactly reaches inside edge of last-cut border ellipse, and cut as follows :—

1st. Begin at 92—83 } count 4 to 1 each cut.  
End at 4—13 }

2d. Begin at 92—35 } count 4 to 1 each cut.  
End at 4—61 }

Now set Lathe at 96—36, and turn forward Slide-rest till one edge of ellipse coincides with *outer* edge of first ellipses, and with its other edge just touches the edge of those ellipses you have just finished, then cut as follows :—

1st. Begin at 96—36 } count 4 to 1 each cut,  
 End at 192—60 }

2d. Begin at 96—84 } count 4 to 1 each cut,  
 End at 192—12 }

and the pattern is finished.

*Note.* If you intend to cut this border pattern *deep*, you must turn the Slide-rest forward rather further from the centre pattern than it appears in Pattern 14.

#### DOUBLE SEA-HEDGEHOG PATTERNS.

In cutting these beautiful patterns you *repeat* a certain part or portion of the Sea-Hedgehog pattern four times over; and in order to obtain these four repetitions in their proper places you will proceed as follows.

#### PATTERN 15.

*Large Double Sea-Hedgehog.*

“ All at centre.”

Scale, }  
 192 ; }

{ Instrument,  
 { Eccentric Cutter.

Then, Eccentric Chuck 5 (five) turns forward.

Slide-rest.....  $2\frac{1}{2}$  (two and a half) turns  
 forward.

Cutter ..... 4 (four) whole turns for-  
 ward.

Then proceed to set Lathe as follows :—

1st Group.

Begin at D.P. 180—E.C.W. 9

End at 108— „ 39

2d Group.

Begin at 180— „ 33 (or 9+24).

End at 108— „ 63 (or 39+24).

3d Group.

Begin at 180— „ 57 (or 33+24).

End at 108— „ 87 (or 63+24).

4th Group.

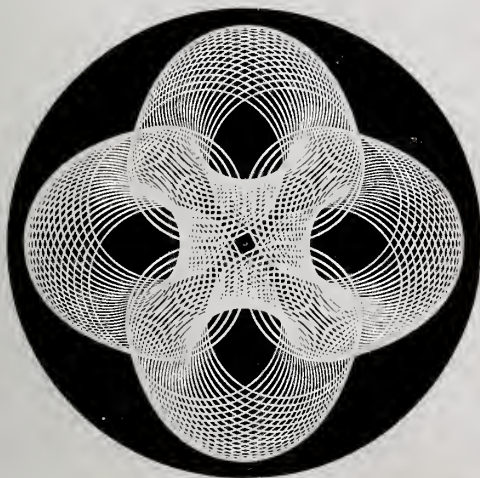
Begin at 180— „ 81 (or 57+24).

End at 108— „ 15 (or 87+24=111—96=15.)

The numbers employed in these Double Sea-Hedgehogs are very simple, and are easily explained.

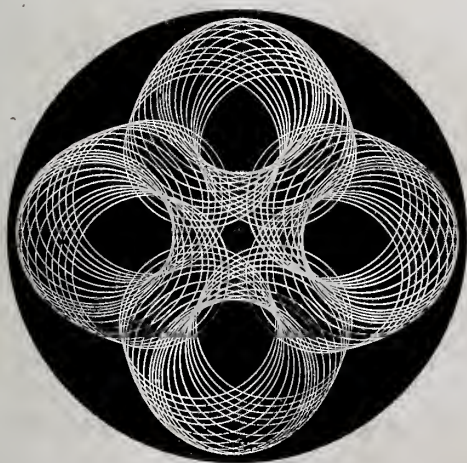
When I made my first trial for one of these patterns, I began by making all the adjustments for a single Sea-Hedgehog (say Pattern 13), and having set the Lathe at 144—96, I took *blind* cuts at 4 to 1 (*i.e.* with the tool *close* to the wood, but without actually touching), until I found that the Cutter-tool would cut a circle just *outside*, and *clear of* the little knob in the centre of the wood; I then read off the Division-plate and the Eccentric Chuck-wheel, and found the Lathe stood at 180—9, or just 3 cuts short of 192—12: I therefore *knew* that the group would *end* at 108—39, or 3 cuts *beyond* 96—36 (*vide* Fig. 12, Plate VII., No. 2 and No. 4); and therefore (as I had just cleared the centre of the wood) I made my first group begin at 180—9, and end at 108—39. Now (as I wanted 4 groups), in fixing the spot to begin my second group, I had only to

*Pattern 15.*



100  
 50  
 16  
 8  
 40  
 11  
 60  
 11  
 16

*Pattern 16.*





begin 24 divisions (or one quarter of 96 on E.C.W.) *beyond* the first-cut of my first group, and end also 24 divisions *beyond* the last cut of my first group, keeping the numbers on the Division-plate *the same as before, because* I only wanted to *change the position* of the next group on the wood. I therefore added 24 to the 9 of the first group, and also 24 to the 39, and my second group stood as follows:—

Begin at 180—33.

End at 108—63.

The 3d and 4th groups were worked out exactly in the same manner, and as the last cut of the 4th group exceeds 96, it is necessary to deduct 96 from it, in order that its true place on the Eccentric Chuck-wheel may be determined: thus,  $87 + 24$  is 111, from which deduct 96, and you have 15 for the true division for the last cut on the E.C.W.

As far as my own taste is concerned, I would advise you not to change the numbers of the cuts here laid down for these patterns, because they are arranged so as just to clear the little knob in the centre, an arrangement which gives (in my opinion) the greatest amount of beauty to the centre part of the pattern, but if you wish to try *fewer* cuts, make your first group

Begin at 192—12 (or No. 2 of Fig. 12),

End at 96—36 (or No. 4 of Fig. 12),

and your second group at 192—36 to 96—60, and so on for the 4 groups, and you will soon be able to judge whether the pattern is the better for having fewer cuts.

## PATTERN 16.

*Large Variegated Double Sea-Hedgehog.*

“ All at Centre.”

---

Scale, {  
192 ;}

{ Instrument,  
{ Eccentric Cutter.

Then, Eccentric Chuck 5 (five) turns forward.

Slide-rest.....  $2\frac{1}{2}$  (two and a half) turns  
forward.

Cutter ..... 4 (four) whole turns for-  
ward.

Set Lathe at 184—10, and cut the 4 groups as  
laid down in Table B, Note 12, at the end.

---

## PATTERN 17.

*Double Sea-Hedgehog, in Alternate Cuts (or count-  
ing 8 to 2, instead of 4 to 1), with Border.*

“ All at Centre.”

---

Scale, {  
192 ;}

{ Instrument,  
{ Eccentric Cutter.

Then, Eccentric Chuck 4 (four) turns forward.

Slide-rest..... 2 (two) turns forward.

Cutter ..... 3 (three) whole turns.

Then cut as directed below for each group, only  
mind and count 8 on the Division-plate to 2 on

Eccentric Chuck-wheel for each cut: thus, 176—8, 184—10, 192—12, 8—14, 16—16, 24—18, 32—20, 40—22, 48—24, and so on as far as directed; but the best way is not to count by *numbers*, but by the small *dots* which mark every 4th division on the Division-plate, saying to yourself two dots (on Division-plate) and two divisions (on E.C. Wheel) for each cut, and only reading the numbers now and then as a check. The 4 groups are as follows:—

1st Group. {Begin at 176—8 } count 8 to 2 for each cut.  
                   {End at 112—40 }

2d Group. {Begin at 176—32 } count 8 to 2 for each cut.  
                   {End at 112—64 }

3d Group. {Begin at 176—56 } count 8 to 2 for each cut.  
                   {End at 112—88 }

4th Group. {Begin at 176—80 } count 8 to 2 for each cut.  
                   {End at 112—16 }

Now for Border proceed as follows:—

Turn back *all to centre*, and mind the cut is now 4 to 1.

Then, Eccentric Chuck 2 (two) turns forward.

Eccentric Cutter 1 (one) turn 2 (two) divisions forward.

Set the Lathe at 180—9, and turn out Slide-rest until the Cutter-tool would cut full clear of pattern; then set Lathe at 192—12, and try that all is correct (if not, turn forward Slide-rest again); then set Lathe again at 180—9, and cut as follows:—

1st Group. {Begin at 180—9 } count 4 to 1 for each cut.  
                   {End at 108—39 }

2d Group. {Begin at 180—33 } count 4 to 1 for each cut.  
                   {End at 108—63 }

3d Group.  $\left\{ \begin{array}{l} \text{Begin at } 180-57 \\ \text{End at } 108-87 \end{array} \right\}$  count 4 to 1 for each cut.

4th Group.  $\left\{ \begin{array}{l} \text{Begin at } 180-81 \\ \text{End at } 108-15 \end{array} \right\}$  count 4 to 1 for each cut.

*Note.* In cutting these Border Patterns (whether they be Single or Double Sea-Hedgehogs, the *greatest care* must be taken to set the Eccentric Chuck *exactly* perpendicular when adjusting the "All at Centre," because, as one pattern works round from right to left, and the other from left to right, a small error becomes *very* palpable, as the original error is *doubled*. It will be seen that, in this pattern, a *very* slight error of this nature has thrown the border slightly over to one side.

## PATTERN 18.

### *Double Sea-Hedgehog in Ellipses.*

"All at Centre."

|         |   |                            |
|---------|---|----------------------------|
| Scale,) | { | Instrument,                |
| 192 ;)  | { | (Elliptical Cutting Frame. |

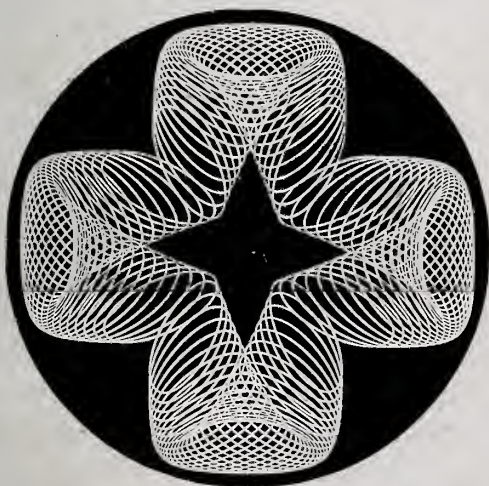
Then, Eccentric Chuck 7 (seven) turns forward.  
 Slide-rest .....  $3\frac{1}{2}$  (three & a half) turns forward.

Then, Elliptical Flange 9 (nine) divisions.  
 Adjustment..... 9 (nine) divisions.  
 Cutter ..... 2 (two) turns 3 (three) divisions.

*Pattern 17.*



*Pattern 18.*





Then cut the 4 groups as follows, at 4 to 1 each cut :—

1st Group.  $\left\{ \begin{array}{l} \text{Begin at } 172-7 \\ \text{End at } 116-41 \end{array} \right\}$  count 4 to 1 for each cut.

2d Group.  $\left\{ \begin{array}{l} \text{Begin at } 172-31 \\ \text{End at } 116-65 \end{array} \right\}$  count 4 to 1 for each cut.

3d Group.  $\left\{ \begin{array}{l} \text{Begin at } 172-55 \\ \text{End at } 116-89 \end{array} \right\}$  count 4 to 1 for each cut.

4th Group.  $\left\{ \begin{array}{l} \text{Begin at } 172-79 \\ \text{End at } 116-17 \end{array} \right\}$  count 4 to 1 for each cut.

As this is rather a large pattern, I subjoin the adjustments for a smaller one, which I have cut in African thorn, with a double-angled tool of  $18^\circ$ .

“ All at Centre.”

|         |   |                            |
|---------|---|----------------------------|
| Scale,) | { | Instrument,                |
| 192 ;)  | { | (Elliptical Cutting Frame. |

Eccentric Chuck 5 (five) turns forward.

Slide-rest.....  $2\frac{1}{2}$  (two and a half) turns forward.

Flange ..... 6 divisions.

Cutter .....  $1\frac{1}{2}$  turns.

Adjustment..... 6 divisions.

Four groups same as the last pattern.

*Note.* For 3 more specimens of Double Sea-Hedgehog, *vide* Note 13 at end of book.

#### STRAIGHT-LINE PATTERNS.

It is well known to all who are conversant with the Elliptical Cutting Frame (or other contrivances of a similar nature), that if you turn out the

Flange and Cutter *equally*, the machine will cut a *straight line*, and also, that the straight line will be exactly *four* times the length of the eccentricity, and consequently of the radius. Thus, if you turn out the Flange 20 divisions, or 2-tenths of an inch, and then turn out the Cutter 20 divisions, or 2 turns, which is equal also to 2-tenths of an inch, the machine will cut a straight line 8-tenths ( $\frac{8}{10}$ ) of an inch in length.

Thus in Pattern 9 the Adjustment for the Straight-Line Pattern was—

Flange 10 (ten) divisions (or  $\frac{1}{10}$  of an inch).

Cutter 10 (ten) divisions (or  $\frac{1}{10}$  of an inch).

And if you will measure the straight line in that pattern with a pair of compasses, you will find that its length is exactly 4-10ths of an inch.

In this instance, again, the rule that is true for the Elliptical Cutting Frame, is equally true when applied to this system of Double-counting; so that, if we only turn forward the Eccentric Chuck and the Slide-rest *equally*, nothing is easier than to produce a series of circles, proceeding from a common centre in perfectly straight lines, the only care necessary being, not to overdo the matter,—for while the Cutter of the Elliptical Cutting Frame produces a straight line by working up and down repeatedly *on the same line*, we content ourselves with taking the up-stroke only, from centre to extremity, and repeating it 4, 6, or 8 times, in order to make a pattern or star from the simple straight line.

---

## PATTERN 19.

*Straight-Line Star of Four Points.*

“ All at Centre.”

|          |                     |
|----------|---------------------|
| Scale, { | { Instrument,       |
| 192 ; }  | { Eccentric Cutter. |

Then, Eccentric Chuck 5 (five) turns forward.

Slide-rest..... 5 (five) turns forward.

Cutter .....  $1\frac{1}{2}$  (one and a half) turns forward.

Then count as follows :

1st Straight Line. {Begin at 144—96 } count 4 to 1 for each cut.  
                          {End at 48—24 }2d Straight Line. {Begin at 148—25 } count 4 to 1 for each cut.  
                          {End at 48—48 }3d Straight Line. {Begin at 148—49 } count 4 to 1 for each cut.  
                          {End at 48—72 }4th Straight Line. {Begin at 148—73 } count 4 to 1 for each cut.  
                          {End at 48—96 }

*Note.* The first cut at 144—96 gives the cut round the *common* centre, and therefore should not be repeated ; so in “2d Straight Line,” instead of beginning at 144—24,\* I begin at the next cut, 148—25 ; and for the next group I added 24 to 25, and obtained 49 (instead of 48) ; and for the last group I added 24 to 49, and obtained 73 (instead of 72), by which means the cut round the common centre is cut once instead of 4 times.

\* Or  $\frac{1}{4}$  of 96, as there are 4 points to the star.

*Note also*, if you require a simple Straight-Line Pattern, cut the 1st and the 3d group, and you will find that the length will be 2 inches and 3-tenths, or 23 tenths, which is thus made up,—Eccentricity,  $5 \times 4 = 20$ , plus Cutter  $1.5 \times 2 = 3 = 23$ ; for you see, in calculating the total length of the pattern, you must add the radius of the Cutter  $1\frac{1}{2}$  turn at each end of the line due to the eccentricity multiplied by 4.

Though this pattern cannot in itself be called beautiful, yet it is most curious and interesting to watch the progress of its development, and to see the gradual production of a Straight-Line Pattern, obtained by the revolution of two wheels moving in contrary directions and at different rates.

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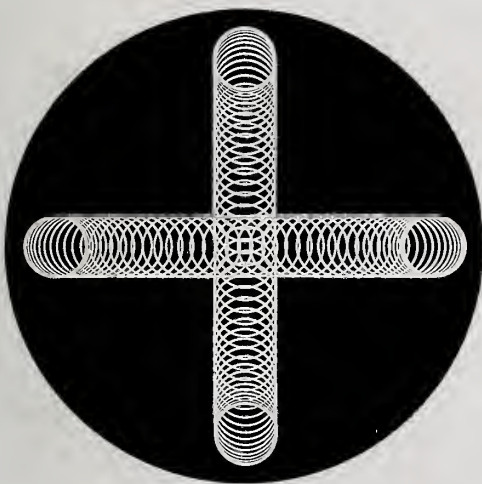
## PATTERN 20.

### *Straight-Line Star of 6 Points in Ellipses.*

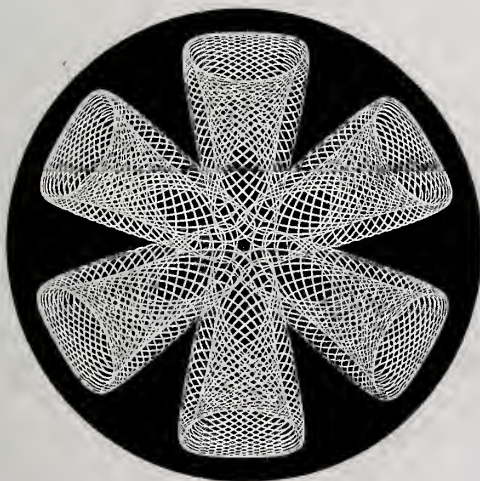
After cutting the last pattern with the Eccentric Cutter, I was curious to see what would be the result of employing the Elliptical Cutting Frame to Straight-Line Patterns; and, after a few trials, I cut Pattern 20, which I think is one of the most beautiful and delicate patterns I ever executed.

The reader will bear in mind that this pattern *does not* stop at 48—24, but has to be cut back again to the centre (or nearly so).

*Pattern 19.*



*Pattern 20.*





“ All at Centre.”

---

|                    |                                              |
|--------------------|----------------------------------------------|
| Scale, )<br>192 ;) | { Instrument,<br>{ Elliptical Cutting Frame. |
|--------------------|----------------------------------------------|

Then, Flange ..... 10 (ten) divisions.

Cutter .....  $2\frac{1}{4}$  (two & a quarter) turns.

Adjustment 10 (ten) divisions.

Set Lathe at 144—96.

Then, Eccentric Chuck 5 (five) turns forward.

Slide-rest ..... 5 (five) turns forward.

As in this pattern I did not wish to encumber the centre with too many cuts, I set the Lathe at 144—96, and took blind cuts until the lower end of the ellipse just touched the little knob left in the centre of the wood. I then read off the Lathe, and found it at 164—5, or the 5th cut *beyond* 144—96. The 1st series, therefore, would stop at 124—43, or 5 cuts *short* of 144—48; and as the star was to have 6 points, the number to be added for the next series would be 16, or  $\frac{96}{6} = 16$ . Therefore cut as follows :—

D.P. E.C.W.

1st Group. { Begin at 164—5 } cut 4 to 1 as usual.  
              { End at 124—43 }

|                               |    |    |    |
|-------------------------------|----|----|----|
| 2d Group. { Begin at 164—21 } | 5  | 43 |    |
| { End at 124—59 }             | 16 | —  | 16 |
|                               | 21 |    | 59 |

|                               |    |    |    |
|-------------------------------|----|----|----|
| 3d Group. { Begin at 164—37 } | 21 | 59 |    |
| { End at 124—75 }             | 16 | —  | 16 |
|                               | 37 |    | 75 |

|                                |    |    |    |
|--------------------------------|----|----|----|
| 4th Group. { Begin at 164—53 } | 37 | 75 |    |
| { End at 124—91 }              | 16 | —  | 16 |
|                                | 53 |    | 91 |

|            |                   |   |                      |         |     |
|------------|-------------------|---|----------------------|---------|-----|
| 5th Group. | {Begin at 164—69} | } | cut 4 to 1 as usual. | 53      | 91  |
|            |                   |   |                      | 16 — 16 |     |
|            | {End at 124—11}   | } |                      | 69      | 107 |
|            |                   |   |                      |         | 96  |
|            |                   |   |                      |         | 11  |
| 6th Group. | {Begin at 164—85} | } | cut 4 to 1 as usual. | 69      | 11  |
|            |                   |   |                      | 16 — 16 |     |
|            | {End at 124—27}   | } |                      | 85      | 27  |

*Note.* I once worked this pattern on a smaller scale, and as it was very beautiful, I here give the Adjustments,—

“All at Centre,” with great care.

|                       |                                 |                                                                 |
|-----------------------|---------------------------------|-----------------------------------------------------------------|
| Flange 8 divisions.   |                                 | Ecc. Chuck 4 turns forw.                                        |
| Cutter 2 whole turns. | } Tool double angle, 16° or 18° | { Slide-rest 4 tns. forw.<br>6 groups counted<br>same as above. |
| Adjust. 8 divisions.  |                                 |                                                                 |

They should be executed on African thorn carefully faced, and brought to an exquisite surface with hard lacquer, or French polish.

#### ON PATTERNS WITH TWO INTERIOR LOOPS, FROM ELLIPSE.

In Mr. Ibbetson's "Brief Account" of his Geometric Chuck, he says, while speaking of "Figures with two loops inwards,"—

“Suadi classes all these curves, consisting of two “loops inwards, with *elliptical motion*; which certainly appears to be their proper association, “because the velocities of two circular motions “which give ellipse are as 2 to 1 in *contrary* “directions, and as two to one in the *same* direction “for figures of two loops inwards.”

Now we shall find, that this system of Double-counting is, in this, as in every other instance, true to the general rules which govern the Geometric and Double Eccentric Chucks.

I have already stated that the Division-plate which I use is so numbered, that when it and the Eccentric Chuck-wheel are both counted *forward* (or in the natural progression of the numbers), they move in contrary directions; so, if we want the two wheels to move in the *same* direction, we have only to count the Division-plate *backwards*, and the Eccentric Chuck-wheel *forwards*, and we shall not only make both wheels move in the same direction, but we shall obtain patterns with two interior loops.

144—96

140— 1

136— 2

132— 3

128— 4

124— 5

120— 6

116— 7

112— 8

108— 9

104—10

100—11

96—12, &amp;c.

This backward-and-forward counting of the two wheels is here shown for 13 cuts, and in working these patterns the counting is invariably carried on in this manner; beginning at 144—96, and continuing until the 96 cuts are completed.

In cutting these interior loops, the Lathe being set at 144—96, the Eccentric Chuck should be turned forward *about*  $6\frac{1}{2}$  turns, and the Slide-rest *about* 4 or  $4\frac{1}{2}$  turns, and then the loop will be of a good size, and well open; while, with the Eccentric Chuck only 4 turns forward, and the Slide-rest 2 turns forward, the loop is solid when Eccentric Cutter is turned out 8 divisions. The reader should also recollect, that the first cut in these patterns is the middle cut at the very end of the loop, nearest the

centre of the wood, and all calculations for cutting parts of loops must be made accordingly.

As the 2-looped figure by itself is of no use as a pattern, it is best to repeat it, or cut another 2-looped figure at right angles to the first, which is done by beginning the first figure at 144—96, and the second at 144—24. Hence, to procure a handsome pattern, the great object of your adjustments is to obtain 4 loops round the centre, as large as they can be made *without cutting into each other*, and this is to be done by moving the Slide-rest, only so far forward as to leave the first cut at some distance from the central knob. A rough trial or two will soon settle this distance if you are inventing a pattern for yourself.

### PATTERN 21.

*A 2-looped Figure, with another 2-looped Figure cut at right angles to it, and afterwards both cut over again.*

“All at Centre.”

|                        |   |                     |
|------------------------|---|---------------------|
| Scale,                 | } | { Instrument,       |
| 192 counted backwards; | } | { Eccentric Cutter. |

Then,

Eccentric Chuck  $6\frac{1}{2}$  (six and a half) turns forward.  
 Slide-rest .....  $4\frac{1}{2}$  (four and a half) turns forward.  
 Cutter ..... 8 (eight) divisions forward.

Then set Lathe at 144—96, and cut all round at 4 to 1 ; counting the Division-plate 4 divisions back-

wards, and the Eccentric Chuck-wheel 1 division forwards for each cut, as I have just shown you in last page, until you have finished 96 cuts, when the 2-looped figure is completed. You have now finished a 2-looped figure, and can judge that it is but of little value alone. Therefore sharpen your tool, and replace it. Set Lathe at 144—24, and cut all round again as before.

You have now cut another 2-looped figure, which is at right angles to the last one.

Now, as in these patterns the circles are rather far apart at the back of the loops, I shall cut them all over again: cutting a larger circle *outside* the present circles of one pattern, and cutting smaller circles *inside* of the present circles of the other pattern, so as to give you a choice of 2 patterns for future use.

1st. The Cutter is at present set at 8 divisions; therefore turn it forward 3 divisions, set the Lathe at 144—24, and cut all round again as before.

Next set Lathe at 144—96 (or as it was set for the first pattern), turn back Cutter to 0, and then set it carefully\* at  $5\frac{1}{2}$  (five and a half) divisions, and cut all round again as before, and when 96 cuts are completed the pattern is finished.

---

\* "Set Cutter carefully at  $5\frac{1}{2}$  divisions;" *vide* Note 14 at end of work.

## PATTERN 22.

*A Jewel of 2 Interior Loops without Backs repeated, surrounded by a broad Ring of Double Circles, with other Ornaments.*

“All at Centre.”

|                         |   |                     |
|-------------------------|---|---------------------|
| Scale,                  | } | { Instrument,       |
| 192 counted backwards ; | } | { Eccentric Cutter. |

*Note.* When the wood is faced and finished ready to receive the pattern, set common Tee-rest close to wood, without however touching it ; adjust the top of rest to the height of the little central knob ; set Lathe at 144, and rule 4 pencil lines *across* the wood at E.C.W. 96, 12, 24, 36. These lines will be found useful in checking the pattern.

Then, Eccentric Chuck 6 (six) turns forward.

Slide-rest..... 4 (four) turns 5 (five)  
divisions forward.

Cutter ..... 6 (six) divisions.

Then cut as follows, minding to move D.P. backwards and E.C.W. forwards,—

1st Loop. {Begin at 20— 7} Count 4 on D.P. *backwards*, to 1 on  
          {End at 76—41} E.C.W. *forwards*, for each cut.

2d Loop. {Begin at 20—31} Count as above.  
          {End at 76—65}

3d Loop. {Begin at 20—55} Count as above.  
          {End at 76—89}

4th Loop. {Begin at 20—79} Count as above.  
          {End at 76—17}

*Pattern 21.*



*Pattern 22.*





Now, I am going to double the cuts in the exterior part of the loop, and to do this proceed as follows. There are six cuts in each part.

*Turn back Cutter 4 (four) divisions.*

1. Set Lathe at 20— 7, and count as before, till you have cut 6 cuts inside former ones.
2. Set Lathe at 96—36                   "                   "                   "
3. Set Lathe at 20—31                   "                   "                   "
4. Set Lathe at 96—60                   "                   "                   "
5. Set Lathe at 20—55                   "                   "                   "
6. Set Lathe at 96—84                   "                   "                   "
7. Set Lathe at 20—79                   "                   "                   "
8. Set Lathe at 96—12                   "                   "                   "

The whole of the loop part of the pattern is now completed, and the remainder is simple Eccentric Cutting, without any double-counting.

For the 4 Rosettes,—

“ All at Centre.”

---

Set Lathe at 192—96 (or upright).

Turn forward —

Eccentric Chuck  $3\frac{1}{2}$  (three and a half) turns.

Cutter .....  $4\frac{1}{2}$  (four and a half) divisions.

Slide-rest.....  $4\frac{1}{2}$  (four and a half) divisions.

Cut rosette, by cutting circles at D.P. 192, 24, 48,  
72, 96, 120, 144, 168.

Set Lathe at 192—24, and cut 2d rosette in the  
same manner.

Set Lathe at 192—48, and cut 3d rosette.

Set Lathe at 192—72, and cut 4th rosette.

Now for the 4 Rings where the back part of loops meet,—

Set Lathe at 192—12.

Turn out Cutter again to 6 divisions.

Turn out Slide-rest till Cutter reaches a little beyond where the 2 last circles of the loops meet, and adjust to touch both (as in pattern), and cut 4 circles at E.C.W. 12, 36, 60, 84. Then turn back Cutter 4 divisions, and cut again at E.C.W. 12, 36, 60, 84.

Now for Shells.

Set Lathe at 192—12.

Turn forward Cutter to 1 turn 8 divisions, and adjust both Cutter and Slide-rest to cut the largest circle of the Shell Pattern, and cut 4 of these at E.C.W. 12, 36, 60, 84.

Turn back Cutter 2 divisions, and turn forward Slide-rest 2 divisions for each circle in the shells, cutting on E.C.W. as before ; and so on till circles get very small, when adjust for the 4 small rings, as in pattern, and then nothing remains to be done but to cut the border of double circles all round, which requires no description.

*Note.* As I have only cut this pattern in very thin strokes, you should be careful in your adjustments ; and examine those laid down, as they may not all suit the full cut of a 16° tool.

---

ON FIGURES PRODUCED BY RATIOS HIGHER  
THAN TWO TO ONE.

---

Having given specimens of most of the principal varieties of the 2 to 1 ratio, I shall now proceed to lay down the rules for all such figures as are produced by the use of higher ratios.

From these rules it will be perceived that a ratio of 3 to 1 produces 3-looped and triangular figures, and a ratio of 4 to 1 produces 4-looped and square figures, and so on—every increase in the ratio giving a corresponding increase to the number of the loops, and to the sides of the polygon.

The looped figures are produced in 3 varieties, by changing the *ratio* between the Eccentric Chuck and the Slide-rest.

Thus, in the first set, the Slide-rest is turned forward *more* than the Eccentric Chuck, and the effect is to place the *back* of each loop *beyond* the centre.

In the second set, the Slide-rest and the Eccentric Chuck are turned forward *equally*, and the effect is that the backs of all the loops *meet* exactly over the *centre*.

In the third set, the Eccentric Chuck is turned forward *more* than the Slide-rest, and the effect is that the backs of all the loops are *short* of the centre.

The polygons are produced by still higher ratios between the Eccentric Chuck and the Slide-rest, which will be specified as they occur. But I shall now give the approximate ratios for the 3 varieties of loops, by means of the Elliptical Cutting Frame.

In examining the formation of elliptical figures on a former occasion, I had recourse to the Elliptical Cutting Frame, in order to prove that the ellipses produced by Double-counting were mathematically true, and coincided exactly with those produced by that instrument.

Now, as within the last few years the Elliptical Cutting Frame has been fitted with a train of wheels working in a ratio of 4 to 1, we have only to use that instrument in order to learn the best and most useful ratios to be employed in producing the looped figures in their 3 varieties, and also to find out the ratio required for the square, or four-sided polygon.

In order to obtain these ratios, I prepared the Elliptical Cutting Frame, by taking out the train of wheels which work together in a ratio of 2 to 1, and carefully substituting the train which work at a ratio of 4 to 1. I then set the Cutter and Flange respectively at 0, and having adjusted the height of tool by standard, as well as getting the point of the tool to cut exactly in the centre, I cut the dot *a* (No. 1, Figure 23).

2d. I turned forward the cutter *alone*, 20 (twenty) divisions, or 2 (two) whole turns, and cut the circle No. 1.

3d. Leaving the Cutter at 20 divisions, I turned forward the Flange only 4 (four) divisions, and cut No. 2, which shows how the loops *first make their appearance*; but this pattern is of no further use to us.

4th. Leaving the Cutter at 20 divisions, I now turned the Flange on to 16 (sixteen) divisions, and

cut No. 3. In which the back of the loops *pass a little beyond the centre of the pattern.*

5th. Still leaving the Cutter at 20 divisions, I now turned the Flange forward also to 20 divisions, and cut No. 4; in which the backs of all the loops *just meet, and touch at the exact centre of the pattern.*

(Thus the ratio of 20 to 20, which in the ellipse produced a straight line, in these many-looped figures causes all the backs of the loops *to meet at the centre.*)

6th. Still leaving the Cutter at 20 divisions, I turned forward the Flange to 24 divisions, and cut No. 5; in which the backs of the loops *do not quite reach the centre, but leave a blank space round it.*

7th. Still leaving the Cutter at 20 divisions, I turned forward the Flange to 30 divisions, and cut No. 6; in which the space round the centre is *larger*, and the loops proportionably *smaller*, than in No. 5; and by increasing the ratio the loops rapidly diminish, and become too small for use.

8th. I now brought both Cutter and Flange back to 0, and having brought the tool just over centre of the wood, I tried for the *square*, which I obtained as follows. I set Cutter forward 5 (five) divisions, and turned Flange forwards 40 divisions (or a ratio of 1 to 8), and cut the square No. 7. *Note.* This is the largest square which can be cut by the instrument, as the divisions on the Flange end at 40.

From this figure we learn that the most useful ratios for us are as follows,—

|             | Cutter.  | Flange.  | Ratio of Cutter to Flange.     |
|-------------|----------|----------|--------------------------------|
| No. 3 ..... | 20 ..... | 16 ..... | (Loops) ..... 5 to 4           |
| No. 4 ..... | 20 ..... | 20 ..... | (Loops) ..... 1 to 1, or equal |
| No. 5 ..... | 20 ..... | 24 ..... | (Loops) ..... 5 to 6           |
| No. 7 ..... | 5 .....  | 40 ..... | (Square) ..... 1 to 8          |

Of these Nos. 3 and 5 must often be *slightly* varied, according to the number of loops in the figure, and also to suit the fancy of the turner; but No. 4 is a fixed ratio.

Now, in this system of Double-counting the Cutter is represented by the *Slide-rest*, and the Flange by the *Eccentric Chuck*—so that our looped figures may be divided into 3 classes, as follows,—

### *Looped Figures.*

#### Class 1.

Backs of Loops beyond Centre of Pattern.

Ratio of Slide-rest to Eccentric Chuck,  
about 5 to 4.

#### Class 2.

Backs of Loops meeting exactly over Centre.

Ratio of Slide-rest to Eccentric Chuck,  
exactly 1 to 1.

#### Class 3.

Backs of Loops short of Centre.

Ratio of Slide-rest to Eccentric Chuck,  
from about 5 to 6.  
to about 4 to 6.

*Fig. 23.*

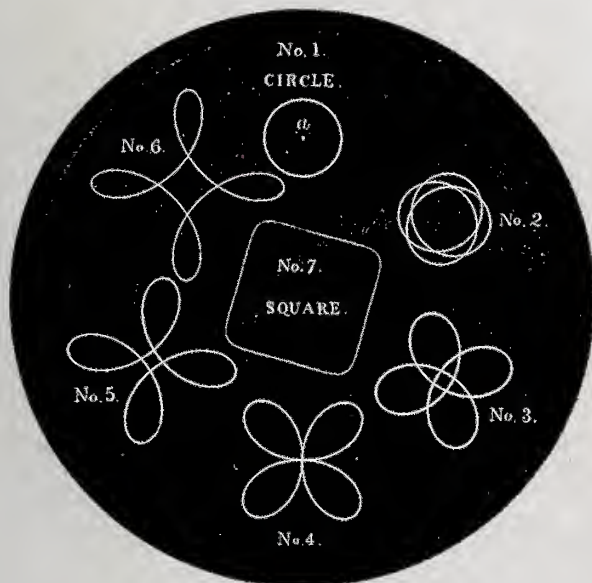
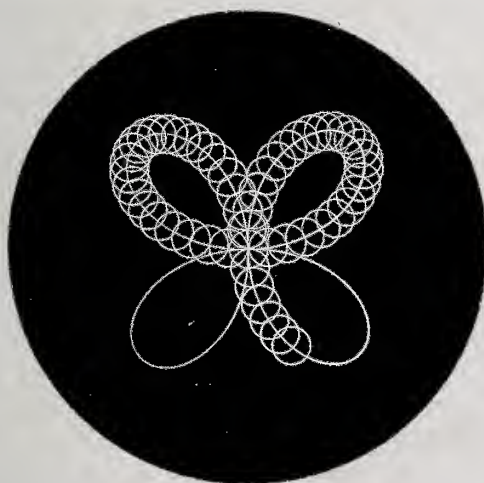


*Fig. 24.*





TEST OF ACCURACY.

---

In order to test the accuracy of my system of Double-counting, when applied to figures of higher ratios than 2 to 1, I determined to subject a 4-looped figure to the same trial, as I had before done with the ellipse. I first cut a large 4-looped figure with the Elliptical Cutting Frame, fitted with the 4 to 1 train of wheels; and then putting in the Eccentric Cutter, I cut over one-half of the pattern with small circles, which were made to follow the exact curves of the 4-looped figure solely by the rules for double-counting. Thus,

1st. Put in the Elliptical Cutting Frame, with 4 to 1 train of wheels.

“All at Centre” most carefully.

---

Set Lathe at 144—96.

Then, Flange ..... 40 (forty) divisions forward (this is the end of Scale).

Cutter ..... 40 (forty) divisions (or 4 turns) forward.

Adjustment  $9\frac{1}{2}$  (nine and a half) turns.

Cut 4-looped figure (*vide* Fig. 24).

I then took out the Elliptical Cutting Frame and put in the Eccentric Cutter, carefully adjusting height of Tool by *Standard*. Then,

“All at Centre.”

---

Then,

Ecc. Chuck 4 (four) turns (or 40 divisions) forward.

Slide-rest . 4 (four) turns (or 40 divisions) forward.

Cutter ..... 1 turn forward.

Set Lathe at 144—96, cut one cut, and then count 8 on D.P. to 1 on E.C.W. for each cut until half of the pattern is cut over (or until E.C.W. come round to 48); then, if any doubt remain on your mind, cut a few more cuts (as they appear on the pattern), and you will see how accurately the tool follows the curved line cut by the Elliptical Cutting Frame. Indeed, there cannot be a more beautiful proof of the exceeding accuracy of this system of “Double-counting” than that afforded by this figure.

Having thus proved the truth of my system, and having laid down a set of rules for executing looped figures, I shall now proceed to apply these rules to the production of 3-looped figures, under the three separate classes which we have just specified.

### Three-Looped Patterns.

1st Class. Back of Loop beyond Centre.

Slide-rest turned forward more than Eccentric Chuck.

### PATTERN 25.

*Three-Looped Figure, with Border round it.*

“All at Centre.”

|          |                     |
|----------|---------------------|
| Scale, { | { Instrument,       |
| 192 ;}   | { Eccentric Cutter. |

Then, Ecc. Chuck 3 (three) turns 2 (two) divisions forward.

Slide-rest . 4 (four) turns forward.

Cutter . . . . . 6 (six) divisions.

*Note.* This ratio is the same as Slide-rest 5 to Eccentric Chuck 4, for multiply both by 8 and you have 40 to 32.

Set Lathe at 144—96, and cut all round at D.P. 6 divisions to E.C.W. 1 division.

*Note.* 6 to 1 is a very *easy* ratio to count, as on the 192 Scale *all the sixes are numbered*, so you have only to move from number to number.

While cutting this pattern, the reader will do well to remark the principal cuts as they occur.

Your first cut, 144—96, is the middle cut of the *back* of the 1st loop.

Next, 48—16, is the middle cut of the *end* of the loop; so that when you are inventing patterns always turn your Lathe to 48—16 (or even 48 alone), to see if the wood is large enough to hold the pattern you require.

Next, 144—32 is the middle cut of the *back* of next loop:

And 48—48 is the middle cut of extreme end of 2d loop.

Next, 144—64 is the middle cut of *back* of last loop.

And 48—80 is the middle cut of extreme end of 3d loop.

In order to explain these numbers it is only necessary to remark, that, as all these figures are completed in 96 cuts, or in one revolution of the Eccentric Chuck-wheel, the ratio of 3 to 1 gives 32 divisions or cuts to each loop; therefore, if the middle of the back of a loop is at 96, the extreme point or end of the loop will be at 16 (or half 32), and the

loop will end where the next begins, at 32; and so for the rest of the numbers.

Now for Border.

Turn forward Slide-rest... 12 (twelve) divisions.

Turn back Ecc. Cutter 3 (three) divisions.

Set Lathe at 144—96, and cut all round again as before.

Here, as in the ellipse, the rule for cutting one set of loops round another (as a border) is, *move forward the Slide-rest alone*. This rule is invaluable.

The Reader will observe, that in the last pattern the centre is almost hidden by the cuts; we will, therefore, now give a pattern with a blank space around the centre. To do this we must slightly change the ratio, but *still* the Slide-rest is turned forward *more* than the Eccentric Chuck, which is the true basis of the rule.

### PATTERN 26.

*Double Three-Looped Figure, with Two Borders.*

“All at Centre.”

|         |  |                     |
|---------|--|---------------------|
| Scale,) |  | { Instrument,       |
| 192 ;)  |  | { Eccentric Cutter. |

Then, Slide-rest ..... 5 (five) turns forward.

Eccentric Chuck 3 (three) turns forward.

Cutter..... 6 (six) divisions forward.

Set Lathe at 144—96, and cut all round, counting 6 to 1.

*Pattern 25.*



*Pattern 26.*





For the next 3 loops, which are to intersect the former ones, set Lathe at 144—16 (*sixteen*), and cut all round as before.

### Border.

Turn back Cutter to 0, and then set it carefully at 2 (two) divisions.

Set Lathe at 144—96, or (as the centre cuts at the backs of the loops are confused by crossing) set Lathe at 48—16.

Turn forward Slide-rest till Cutter would cut a very small circle clear of the last pattern, but do not cut.

Now set Lathe at D.P. 6—E.C.W. 9, and proceed as follows:—

|     |                 |                            |                           |
|-----|-----------------|----------------------------|---------------------------|
| 1st | {Begin at 6—9}  | count 6 to 1 for each cut. |                           |
|     | {End at 90—23}  |                            |                           |
| 2d  | {Begin at 6—25} | " "                        | 9 + 16 = 25               |
|     | {End at 90—39}  |                            | 23 + 16 = 39              |
| 3d  | {Begin at 6—41} | " "                        | 25 + 16 = 41              |
|     | {End at 90—55}  |                            | 39 + 16 = 55              |
| 4th | {Begin at 6—57} | " "                        | and so on.                |
|     | {End at 90—71}  |                            |                           |
| 5th | {Begin at 6—73} | " "                        |                           |
|     | {End at 90—87}  |                            |                           |
| 6th | {Begin at 6—89} | "                          | 87 + 16 = 103; 103—96 = 7 |
|     | {End at 90—7}   |                            |                           |

*Note.* The way I got D.P. 6 and E.C.W. 9 was as follows. I set the Lathe at 144—96, and instead of taking blind cuts till I reached the required spot, I took 8 blind cuts at once by setting the Lathe at 192—8, when I soon found that the next cut, 6—9, was the exact cut I required; and as 9 is 7 cuts

short of 16, and as  $48-16$  is the point of the loop, I should end at  $16 + 7$  or 23, and  $48 + (7 \times 6) = 90$ .

### Second Border.

Turn Cutter forward to 10 (ten) divisions.

Set Lathe at  $48-16$ .

Turn forward Slide-rest till the cut is quite clear of the dots you have just finished (as in pattern).

Now set Lathe (as before) at D.P. 6—E.C.W. 9, and you will find that one cut forward will be just what you want ; therefore begin one cut beyond what you did last time, and end one cut short of it, as follows :—

|     |                  |                            |   |
|-----|------------------|----------------------------|---|
| 1st | {Begin at 12—10} | count 6 to 1 for each cut. |   |
|     | {End at 84—22}   |                            |   |
| 2d  | {Begin at 12—26} | "                          | " |
|     | {End at 84—38}   |                            |   |
|     |                  | 10 + 16 = 26<br>&c. &c.    |   |
| 3d  | {Begin at 12—42} | "                          | " |
|     | {End at 84—54}   |                            |   |
| 4th | {Begin at 12—58} | "                          | " |
|     | {End at 84—70}   |                            |   |
| 5th | {Begin at 12—74} | "                          | " |
|     | {End at 84—86}   |                            |   |
| 6th | {Begin at 12—90} | "                          | " |
|     | {End at 84— 6}   |                            |   |

Now, as these circles are rather far apart, you might reduce the Cutter 4 divisions, and cut all round again, but I prefer to

Turn *back* Cutter ... 3 (three) divisions.

Turn *forward* Slide-rest 3 (three) divisions, and cut all round again by last Table, beginning at  $12-10$ , &c.

## PATTERN 27.

*Three-Looped Figure of the 1st Class, in Shells.*

“All at Centre.”

|          |                     |
|----------|---------------------|
| Scale, } | { Instrument,       |
| 192 ; }  | { Eccentric Cutter. |

Then, Eccentric Chuck 3 (three) turns forward.

Slide-rest.....  $6\frac{1}{2}$  (six and a half) turns forward.Cutter .....  $2\frac{1}{2}$  (two and a half) turns forward.Set Lathe at 144—96, and cut all round at 24 to 4. (*Vide* Table C, note 15, at the end.)

Having cut all round by Table,—

Turn back Cutter ... 2 (two) divisions (mind loss of time).

Turn forward Slide-rest 2 (two) divisions, and cut all round again as before, by Table C.

Do this three times more.

Then turn back Cutter ... 5 (*five*) divisions, turn forward Slide-rest 5 (five) divisions, and cut round again.

Then reduce Cutter ... 2 (two) divisions, and turn forward Slide-rest 2 (two) divisions, and cut round again.

Reduce as before, and cut round again.

Reduce 5 divisions, turn forward 5 divisions, and cut round for the last time.

## CLASS 2. BACKS OF LOOPS MEETING OVER CENTRE.

The simplest figure of this class hardly deserves an engraving, but as it is a brilliant pattern, if the wood is carefully *lined*, and the pattern is cut in bright dots with a single-angle tool of about  $12^\circ$  or  $16^\circ$ , I shall give the adjustments, and the reader can judge for himself.

*Note.* Whenever you wish to cut a pattern in dots with a single-angle tool, adjust for *height* and *centre* with a double-angle tool, and then put in a single-angled one to cut the pattern.

Adjustments for a double 3-looped pattern, with backs of loops over centre.

“All at Centre” (no figure).

|          |                     |
|----------|---------------------|
| Scale, { | { Instrument,       |
| 192 ; }  | { Eccentric Cutter. |

Then, Eccentric Chuck 4 (four) turns forward.

Slide-rest ..... 4 (four) turns forward.

Cutter Single-angle Tool adjusted to cut a small dot.

Set Lathe at 150—1, and cut all round at 6 to 1.

*Note.* In cutting patterns in *dots*, it is best to cut your first cut, and *settle its depth* on the flat surface of the wood, instead of trying to cut down the small knob left in the middle of the wood ; *therefore* make your first cut, and settle the *size* and *depth* at 150—1, and cut away the central knob the next time at 144—32, and then cut blind at 144—64.

To Double the Pattern.

In order to prevent crowding the centre of the pattern, the next or intermediate loops are cut two

*Pattern 27.*



*Pattern 28.*





cuts short at each end; therefore, instead of beginning at 144—16,

|                 |  |                 |  |                 |
|-----------------|--|-----------------|--|-----------------|
| Begin at 156—18 |  | Begin at 156—50 |  | Begin at 156—82 |
| End at 132—46   |  | End at 132—78   |  | End at 132—14   |

We will now explain some more complex patterns.

### Rule for Borders for Class 2.

Borders are still to be worked by moving forward the Slide-rest *alone*, but as the two curves are not quite coincident, it is best to leave the space of half a tenth of an inch between them; they approach a trifle at the shoulder of the loop.

### PATTERN 28.

*Double 3-Looped Pattern in Circles, Ratio 5 to 5, with Straight-Line Pattern between the Loops.*

“All at Centre.”

|          |                     |
|----------|---------------------|
| Scale, { | { Instrument,       |
| 192 ; }  | { Eccentric Cutter. |

Then, Eccentric Chuck 5 (five) turns forward.

Slide-rest ..... 5 (five) turns forward.

Set Lathe at 144—96.

Cutter .....  $8\frac{1}{2}$  (eight and a half) divisions forward (or to cut exactly over centre at 2d cut).

Cut one cut at 144—96, and then cut all round at 6 to 1, minding, however, to cut *blind* at 144—32 and 144—64, or the two cuts which subsequently pass over already cut centre. Then intermediate loops (not to crowd centre) as follow :—

| 1st.            | 2d.             | 3d.             |
|-----------------|-----------------|-----------------|
| Begin at 156—18 | Begin at 156—50 | Begin at 156—82 |
| End at 132—46   | End at 132—78   | End at 132—14   |

To cut straight lines do not touch the adjustments, but simply set Lathe as directed below, and count 4 to 1 each cut instead of 6 to 1:—

1st {Begin at 184—10 } count 4 to 1 each cut.  
       {End at 48—24 }

2d {Begin at 184—26 }       "       "  
     {End at 48—40 }

3d {Begin at 184—42 }       "       "  
     {End at 48—56 }

4th {Begin at 184—58 }       "       "  
       {End at 48—72 }

5th {Begin at 184—74 }       "       "  
       {End at 48—88 }

6th {Begin at 184—90 }       "       "  
       {End at 48— 8 }

*Note.* I set Lathe at 144—96, and took blind cuts at 4 to 1 until I came to 184—10, when I cut one cut, and ended of course at 48—24.

## PATTERN 29.

*Double 3-Looped Pattern, with Border; Inside Pattern just within the ratio of  $4\frac{1}{2}$  to  $4\frac{1}{2}$ ; Border just beyond ratio of  $4\frac{1}{2}$  to  $4\frac{1}{2}$ : so that the Pattern and Border overlap.*

“All at Centre.”

Scale, {  
       192 ; }

{ Instrument,  
 { Eccentric Cutter.

Then,

Eccentric Chuck 4 (four) turns 5 (five) divisions.  
 Slide-rest..... 4 (four) turns 3 (*three*) divisions.  
 Cutter ..... 6 (six) divisions.

Set Lathe at 144—96, and cut all round at 6 to 1.

### Intermediate Loops.

Begin 2 cuts beyond 144—16, or at 156—18, and cut on (at 6 to 1 each cut) to 132—46; then take blind cuts to 156—50; cut there, and cut on (at 6 to 1) to 132—78; then take blind cuts to 156—82; cut there, and cut on (at 6 to 1) to 132—14; when the double 3-loop pattern is finished.

### Border.

Turn forward Slide-rest 11 (eleven) divisions.

Cutter ... 2 (two) divisions, and cut as below directed :—

|                        |                                    |                                                                                          |
|------------------------|------------------------------------|------------------------------------------------------------------------------------------|
|                        |                                    | For outside dots turn forward Slide-rest $1\frac{1}{2}$ turns, reduce Cutter, and cut :— |
| 1st Border.            | { Begin at 180—6<br>End at 108—26  |                                                                                          |
| 2d Border.             | { Begin at 180—22<br>End at 108—42 | 1st Set. { Begin at 192—8<br>End at 96—24                                                |
| 3d Border.             | { Begin at 180—38<br>End at 108—58 | 2d Set. { Begin at 192—24<br>End at 96—40                                                |
| 4th Border.            | { Begin at 180—54<br>End at 108—74 | 3d Set. { Begin at 192—40<br>End at 96—56                                                |
| 5th Border.            | { Begin at 180—70<br>End at 108—90 | 4th Set. { Begin at 192—56<br>End at 96—72                                               |
| 6th Border.            | { Begin at 180—86<br>End at 108—10 | 5th Set. { Begin at 192—72<br>End at 96—88                                               |
|                        |                                    | 6th Set. { Begin at 192—88<br>End at 96—8                                                |
| Cut 6 to 1 throughout. |                                    | Cut 6 to 1 throughout.                                                                   |

As there is too much space left bare where the dots end, proceed to cut one dot more, as follows:—

“All at Centre.”

---

Set Lathe at 192—8.

Turn forward (or down, as we may call it, from the position) Eccentric Chuck  $7\frac{1}{2}$  (seven and a half) turns.

Set Cutter again to cut a dot as before, and cut a dot at 192—8, and then cut a dot at 24, 40, 56, 72, 88. I have only cut dots at 8, 40, and 72, leaving the other three places in order to show why they were required.

---

### PATTERN 30.

*Horizontal Ellipses over Centre.*

“All at Centre.”

---

|          |                             |
|----------|-----------------------------|
| Scale, { | { Instrument,               |
| 192; }   | { Elliptical Cutting Frame. |

|                       |   |                       |
|-----------------------|---|-----------------------|
| Then, Eccentric Chuck | 4 | (four) turns forward. |
| Slide-rest.....       | 4 | (four) turns forward. |

|                   |   |                    |
|-------------------|---|--------------------|
| Then, Flange..... | 8 | (eight) divisions. |
|-------------------|---|--------------------|

|              |   |              |
|--------------|---|--------------|
| Cutter ..... | 2 | (two) turns. |
|--------------|---|--------------|

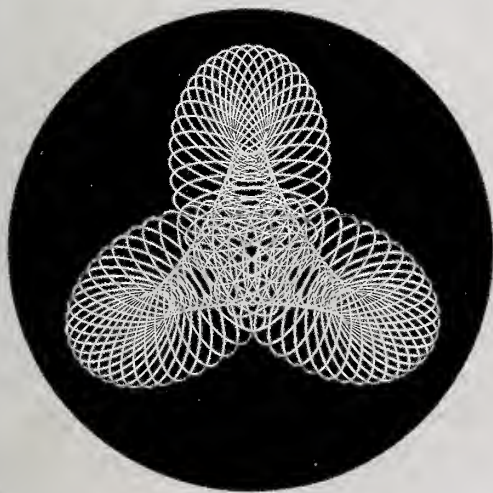
Adjustment.....  $39\frac{1}{2}$  (thirty-nine and a half) turns, *i.e.* 2 (two) for adjustment and  $37\frac{1}{2}$  for horizontal.

Set Lathe at 144—96, and cut all round at 6 to 1 each cut.

*Pattern 29.*



*Pattern 30*





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 LOOPED FIGURES. 3D CLASS.
 

---

## Backs of Loops short of Centre.

In this class, in figures of only 3 loops, the loop becomes so *narrow*, that the Eccentric Cutter ceases to give patterns of any beauty; but this is not the case with the Elliptical Cutting Frame. With that instrument I have executed patterns alike curious and beautiful, some of which I shall lay before my readers.

## PATTERN 31.

*Double 3-Looped Figure in small Ellipses, one set Horizontal, the other set Vertical Ellipses.*

“All at Centre.”

---

|          |                             |
|----------|-----------------------------|
| Scale, { | Instrument,                 |
| 192; }   | { Elliptical Cutting Frame. |

1st Set. Horizontal Ellipses.

Cutter ..... 10 divisions.

Flange .....  $2\frac{1}{2}$  divisions.

Adjustment.....  $38\frac{1}{2}$  turns (or  $37\cdot 2^{\text{T. d.}} + 2\frac{1}{2}^{\text{d.}} = 38\cdot\frac{1}{2}$ , or 38 turns and *half a division*).

Then, Eccentric Chuck 6 (six) turns.

Slide-rest..... 4 (four) turns.

Set Lathe at 144—96, and cut all round at 6 to 1.

2d Set. Vertical.

Turn back Adjustment of Elliptical Cutting Frame to 0, and then set it carefully at  $2\frac{1}{2}$  (two and a half) divisions.

Set Lathe at 144—16 (*sixteen*), and cut all round at 6 to 1.

## PATTERN 32.

*3-Looped Figure in Large Horizontal Ellipses.*

“All at Centre.”

---

|                     |                                              |
|---------------------|----------------------------------------------|
| Scale, }<br>192 ; } | { Instrument,<br>{ Elliptical Cutting Frame. |
|---------------------|----------------------------------------------|

Then, Flange ..... 8 (eight) divisions.

Cutter ..... 2 (two) turns.

Adjustment .....  $39\frac{1}{2}$  (thirty-nine and a half) turns (or  $37\cdot2$  for horizontal + 8 divisions (or 2 turns) =  $39\cdot2$ ).

Then, Set Lathe at 144—96.

Eccentric Chuck 6 (six) turns.

Slide-rest is to be turned forward until the edge of horizontal ellipse approaches centre, as in pattern (or about 2 turns 3 or 4 divisions), and then cut all round at 6 to 1.

## PATTERN 33.

*3-Looped Figure in Large Vertical Ellipses.*

“All at Centre.”

---

|                     |                                              |
|---------------------|----------------------------------------------|
| Scale, }<br>192 ; } | { Instrument,<br>{ Elliptical Cutting Frame. |
|---------------------|----------------------------------------------|

Then, Flange ..... 8 (eight) divisions.

Cutter ..... 2 (two) turns.

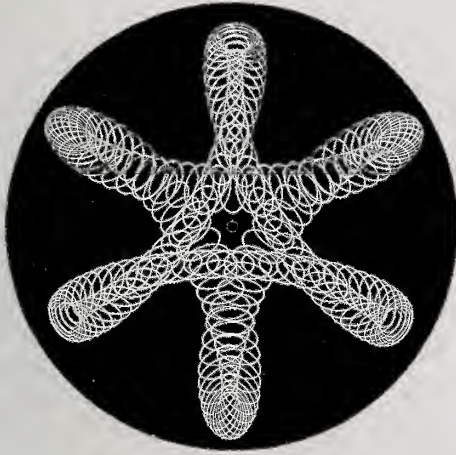
Adjustment ..... 8 (eight) divisions.

Then, Eccentric Chuck 7 (seven) turns forward.

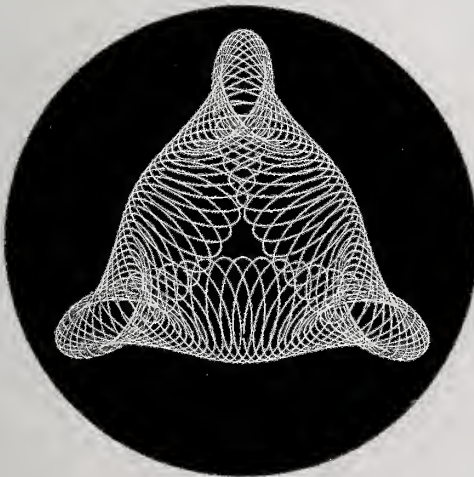
Slide-rest ..... 4 (four) turns.

Set Lathe at 144—96, and cut all round at 6 to 1.

*Pattern 31.*



*Pattern 32.*





## PATTERN 34.

*Beautiful 8-Point Star or Rosette (from Pattern 33).*

“ All at Centre.”

|          |                             |
|----------|-----------------------------|
| Scale, { | { Instrument,               |
| 192 ; }  | { Elliptical Cutting Frame. |

Then, Flange..... 8 (eight) divisions forw.  
 Cutter ..... 2 (two) turns.  
 Adjustment..... 8 (eight) divisions.

Then, Eccentric Chuck 6 (six) turns forward.  
 Slide-rest.. .....  $3\frac{1}{2}$  (three & a half) turns  
 forward.

Set Lathe as follows, and cut at 6 to 1 :—

1st Point.  $\left\{ \begin{array}{l} 174-5 \\ 114-27 \end{array} \right\}$  count 6 to 1 for each cut.

2d Point.  $\left\{ \begin{array}{l} 174-17 \\ 114-39 \end{array} \right\}$         ”        ”

3d Point.  $\left\{ \begin{array}{l} 174-29 \\ 114-51 \end{array} \right\}$         ”        ”

4th Point.  $\left\{ \begin{array}{l} 174-41 \\ 114-63 \end{array} \right\}$         ”        ”

5th Point.  $\left\{ \begin{array}{l} 174-53 \\ 114-75 \end{array} \right\}$         ”        ”

6th Point.  $\left\{ \begin{array}{l} 174-65 \\ 114-87 \end{array} \right\}$         ”        ”

7th Point.  $\left\{ \begin{array}{l} 174-77 \\ 114-3 \end{array} \right\}$         ”        ”

8th Point.  $\left\{ \begin{array}{l} 174-89 \\ 114-15 \end{array} \right\}$         ”        ”

The centre pattern looks beautiful when cut, but does not show well in print : the counting is on the Eccentric Chuck-wheel alone.

“ All at Centre.”

---

Cutter ..... 12 divisions.

Flange..... 5 divisions.

Adjustment..... *none*.

Turn forward Slide-rest till Cutter cuts *just* beyond centre; count at each of the 6's on the E.C.W. thus : 96, 6, 12, 18, 24, &c.

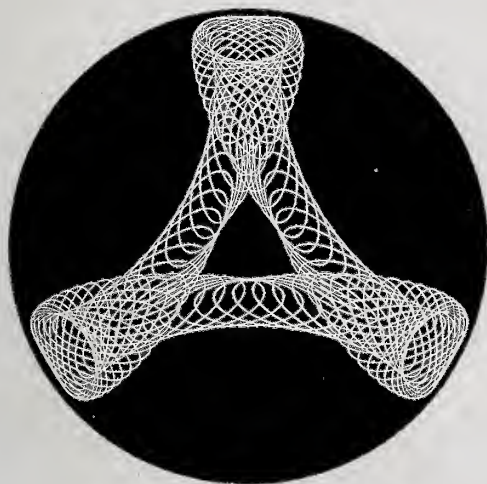
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#### INTERIOR LOOPS.

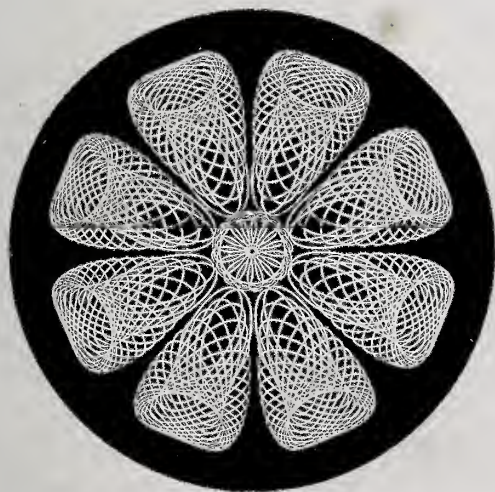
As a general rule, Interior Loops may be classed as 3d-class loops, and the loop is always largest when there is *least difference* between the turning forward of the Eccentric Chuck and Slide-rest. Thus, suppose the Lathe set at 144—96, and the Cutter turned forward 4 divisions to cut a small circle; if you require the largest loop, turn forward the Eccentric Chuck (say) 6 turns, then turn forward Slide-rest until the Cutter touches little knob at the centre, or about 5 turns 6 divisions.

You may unquestionably try the loops by turning out Slide-rest till the Cutter is *beyond* the centre, like 1st-class loops ; but you will find the backs of the loops useless for patterns, in consequence of the individual cuts being so very far apart : I have made trial of these, and cannot recommend them.

*Pattern 33.*



*Pattern 34.*





## PATTERN 35.

*Three Interior Loops and Three Exterior Loops.*

“All at Centre.”

|          |                     |
|----------|---------------------|
| Scale, { | { Instrument,       |
| 192 ; }  | { Eccentric Cutter. |

1st Exterior Loops. (3d Class.)

Eccentric Chuck 5·8 (five) turns (eight) divisions.

Slide-rest..... 4·2 (four) turns (two) divisions.

Cutter ..... 4 (four) divisions.

Set Lathe at 144—96, and cut all round at 6 to 1.

2d Interior Loops.

Set Lathe again at 144—96, and turn *back* Slide-rest until Cutter would cut just outside of first cut of exterior loops, and then cut all round at 6 to 1, minding to count the Division-plate *backwards* and the Eccentric Chuck-wheel *forwards*: thus, 144—96, 138—1, 132—2, 126—3, 120—4, 114—5, 108—6, 102—7, 96—8, and so on all round.

## PATTERN 36.

*Three Interior Loops, doubled, and highly Ornamented.*

“All at Centre.”

|          |                     |
|----------|---------------------|
| Scale, { | { Instrument,       |
| 192 ; }  | { Eccentric Cutter. |

Then, Eccentric Chuck 4·8 (four) turns (eight) divisions forward.

Slide-rest..... 4 (four) turns forward.

Cutter ..... 5 (five) divisions forward.

Set Lathe at 144—96, and cut all round at 6 to 1, minding to count the Division-plate 6 backwards and Eccentric Chuck-wheel 1 forwards for each cut (as shown in last pattern).

Then, turn *back* Slide-rest 2 (two) turns, set Lathe at 144—96, and cut all round again as before.

Now for Double-back of these Loops.

Turn forward Cutter ... 3 (three) divisions.

Slide-rest 3 (three) divisions, and adjust (if necessary), and then count as follows :—

- |           |                  |                                     |
|-----------|------------------|-------------------------------------|
| 1st Back. | {Begin at 84—10} | count 6 backwards to 1 forwards for |
|           | {End at 12—22}   | each cut.                           |
| 2d Back.  | {Begin at 84—42} | ” ” ”                               |
|           | {End at 12—54}   |                                     |
| 3d Back.  | {Begin at 84—74} | ” ” ”                               |
|           | {End at 12—86}   |                                     |

Now for Backs of First-cut Loops.

Set Lathe at 144—96. Turn forward Cutter 2 (two) divisions, then turn forward Slide-rest till Cutter would cut into the inside edge of the 1st cut of your former large loop, and cut the backs of these loops as you did the last, by beginning at 84—10, and ending at 12—22, as before.

This pattern shows with what ease the highest degree of finish may be given to these sort of patterns when the movement of the Slide-rest alone is required to enlarge or diminish the loops. Thus, in this instance, if you think the outside pattern too simple, proceed as follows :—

*Pattern 35.*



*Pattern 36.*





Turn back Cutter ... 2 (two) divisions.

Slide-rest 2 (two) divisions, and cut again as before, from 84—10 to 12—22, &c. &c., and and so on to any amount of richness you may fancy.

---

### ON TRIANGLES.

---

We have now arrived at the Triangular Patterns, and therefore a few remarks on the Polygons, produced by Double-counting, will not be misplaced.

1st. The power of producing figures with straight sides by Double-counting appears to depend on being able to hit a mean between the ratio which would produce a circular pattern and one which would produce a figure with concave sides (*vide* Note 16). This exact ratio varies as often as the number of the sides in the polygon change, and no small degree of patience was required before I could work out the ratio for each. At page 55 I showed you that with the 4-to-1 train of wheels in the Elliptical Cutting Frame, the square was obtained by a ratio of Flange 40 to Cutter 5, or *eight to one*; and in Double-counting, I found that the square was obtained by Eccentric Chuck 8 turns to Slide-rest 1 turn forward, the ratio being identical; and after many trials I found that the ratio required for a triangle with straight sides was, Eccentric Chuck 8 turns to Slide-rest 2 (two) turns 2 (two) divisions forward. The other polygons differ in the same way, and have each a peculiar ratio, which will be given as they occur.

2d. If the Reader will turn to Fig. 23 (page 56), he will perceive that the angles of the square are all *rounded*. This is the case with the angles of all polygons produced by Ibbetson's Geometric Chuck, or by Double-counting; but as *we* work in patterns, and not in single lines, we possess the particular advantage of being able to make the *interior angles* of our polygons perfectly sharp,—by merely increasing the size of the circle cut by the Eccentric Cutter, as by this means the *inner curve* at each angle is entirely hidden, and the two sides meet at a sharp and true angle.

3d. In these polygons the Slide-rest can no longer be used alone if we wish to inclose one polygon within another, it being necessary to retain the ratio between the Eccentric Chuck and Slide-rest in every change of size; I shall, therefore, in all cases of polygons, first give a table of ratios, and then proceed to such examples as may be requisite for illustration.

*Table of Ratios for Triangles.*

| Eccentric Chuck. | Slide-rest.                       |
|------------------|-----------------------------------|
| 10 turns .....   | 2 turns $7\frac{1}{2}$ divisions. |
| 8 turns .....    | 2 turns 2 divisions.              |
| 6 turns .....    | 1 turn $6\frac{1}{2}$ divisions.  |
| 5 turns .....    | 1 turn $3\frac{3}{4}$ divisions.  |
| 4 turns .....    | 1 turn 1 division.                |
| 3 turns .....    | 0 „ $8\frac{1}{4}$ divisions.     |
| 2 turns .....    | 0 „ $5\frac{1}{2}$ divisions.     |

*Note.* 10 turns to  $2\cdot7\frac{1}{2}$  is almost too large, unless, after cutting round *once*, you cut round again with a slightly reduced radius to the Cutter.

## PATTERN 37.

*Large Triangle enclosing Smaller one.*

“ All at Centre.”

Scale, }  
192 ; }{ Instrument,  
{ Eccentric Cutter.

Outer Triangle.

Then, Ecc. Chuck 8 (eight) turns forward.

Slide-rest . 2 (two) turns 2 (two) divisions  
forward.

Cutter ... 5 (five) divisions forwards.

Set Lathe at 144—96, and cut round 6 to 1.

Inner Triangle.

Turn back to “ All at Centre.”

Then, Ecc. Chuck 5 (five) turns forward.

Slide-rest . 1 (one) turn  $3\frac{3}{4}$  (three and three  
quarters) divisions forward.Cutter ... 1 (one) turn 1 (one) division  
forward.

Set Lathe at 144—96, and cut all round at 6 to 1.

*Note.* In the outside triangle of this pattern, owing to the Cutter only being turned forward 5 divisions, the angles are all evidently *rounded*. But in the next pattern this defect is remedied, by merely increasing the radius of the Cutter.

## PATTERN 38.

*Triangle within Triangle, both with sharp Interior Angles.*

“All at Centre.”

Scale, }  
192 ; }

{ Instrument,  
{ Eccentric Cutter

Large Triangle.

Ecc. Chuck 8 (eight) turns forward.

Slide-rest... 2 (two) turns 2 (two) divisions.

Cutter ..... 1 (one) turn 2 (two) divisions.

Set Lathe at 144—96, and cut as before.

Small Triangle, “All at Centre,” then,

Eccentric Chuck 4 turns forward.

Slide-rest..... 1 turn 1 division forward.

Cutter ..... 1 turn 3 divisions forward.

Set Lathe at 144—96, and cut as before at 6 to 1  
all round.

*Note.* In all these double triangles it is better to go back all to centre and adjust afresh, instead of turning *back* the former adjustments, as the least oversight (as loss of time, &c.) would produce a curved side.

## PATTERN 39.

*Triangle in Shells, with Interior Triangle in Double Circles (one within the other).*

This curious pattern is not difficult, if you will only attend strictly to the instructions.

*Pattern 37.*



*Pattern 38.*





“ All at Centre.”

---

|                     |                                      |
|---------------------|--------------------------------------|
| Scale, }<br>192 ; } | { Instrument,<br>{ Eccentric Cutter. |
|---------------------|--------------------------------------|

Then, Ecc. Chuck 7 (seven) turns 3 (three) divisions forward.

Slide-rest . 2 (two) turns forward.

Cutter..... 2 (two) turns forward.

Set Lathe at 144—96, and cut all round by Table C (Note 15), at 24 to 4 each cut.

Then set Lathe again at 144—96.

Turn forward Ecc. Chuck 2 (two) divisions.

Slide-rest .  $\frac{1}{2}$  (one-half) division.

Turn *back* Cutter .....  $1\frac{1}{2}$  (one and a half) division  
(and mind loss of time).

Cut all round as before by table, counting 24 to 4 each cut.

Do this 4 times more, being careful each time

To set Lathe at 144—96,

To turn forward Ecc. Chuck 2 divisions,

To turn forward Slide-rest  $\frac{1}{2}$  division,

To turn *back* Cutter  $1\frac{1}{2}$  divisions, and

To count round by Table C.

Now for Inner Triangle.

Turn back to “ All at Centre.”

Set Lathe at 144—96.

Turn forward Ecc. Chuck 3 (three) turns.

Slide-rest .  $8\frac{1}{4}$  (eight and a quarter)  
divisions.

Cutter ..... 1 (one) turn  $3\frac{1}{2}$  (three &  
a half) divisions (or to reach to 2d cut of Shell

Pattern), and cut all round at 12 to 2. When done set Lathe again at 144—96 ; and, lastly, reduce Cutter 3 (three) divisions, and cut all round again at 12 to 2 as before, when the pattern is finished.

---

### PATTERN 40.

Before leaving the beautiful ratio of 3 to 1, I must introduce my readers to an exquisitely brilliant pattern, which I call from its figure a *Hexagon in Ellipses*, although the ratio is really only 3 to 1, like the 3-loop and triangular figures. The whole art of cutting this pattern consists, first, in taking great pains with your adjustments, and next, in *never* moving the Slide-rest from its central position in “All at Centre;” for if the Slide-rest is moved forward even in a trifling degree, the sides cease to be parallel, and the attempt to regain the triangular shape due to the ratio is clearly perceptible.

“All at Centre.”

---

|          |                             |
|----------|-----------------------------|
| Scale, { | { Instrument,               |
| 192 ; }  | { Elliptical Cutting Frame. |

Then, Flange..... 8 (eight) divisions.

Cutter..... 2 (two) whole turns.

Adjustment 8 (eight) divisions.

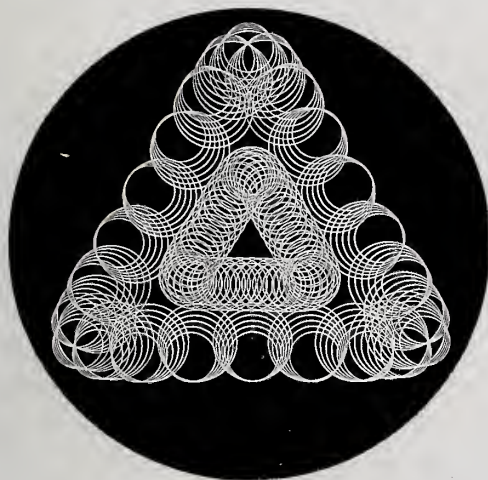
Then, Eccentric Chuck  $9\frac{1}{2}$  (nine and a half) turns forward.

Slide-rest..... *Not to be moved at all.*

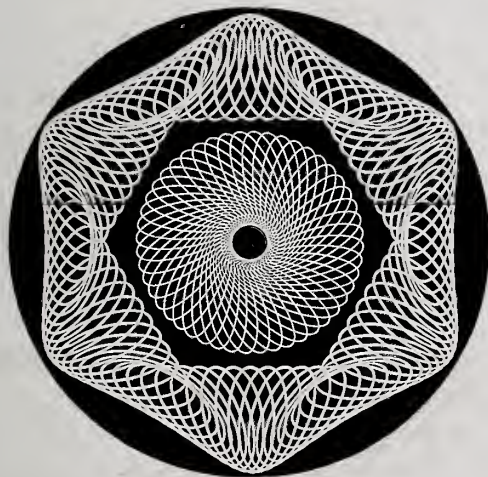
Set Lathe at 144—96, and cut all round at 6 to 1  
for each cut.

The centre is not Double-counting.

*Pattern 39.*



*Pattern 40.*





ON FOUR-LOOPED AND SQUARE FIGURES.

---

We have now arrived at the patterns whose ratio in double-counting is 4 to 1, and there are a few matters to which I must call the reader's attention.

1. As our Eccentric Chuck-wheel has only 96 divisions, each loop in these patterns will only contain 24 cuts; a circumstance which in some of the figures necessitates a reduction in size, or the cuts would be too far apart. This remark applies particularly to the loops of the second and third class, when cut in dots or very small circles. Those, however, cut in ellipses still retain their size unimpaired, and to these, as both new and curious, we shall especially direct our attention.

2d. As the Division-plate moves exactly once round for every 24 cuts of a pattern, we are enabled to obtain a much easier method of counting, by changing the scale we use from 192 to 120; for it so happens that in this instance the 120 scale is much more suited to our purpose than the 192 scale, because the 120 scale is *numbered at all the 5's* (thus: 5, 10, 15, 20); and as 120 divided by 5 is equal to 24, it is clear that counting 5 on the 120 scale each cut is the same as counting 8 on the 192 scale; but while the 8's are (as I may say) obscurely marked on the 192 scale by dots, the 5's on the 120 scale are all numbered—so that in moving from one marked 5 to another a mistake is almost impossible, whereas, especially when the mind is engaged in inventing a pattern, nothing would be easier than to

make a slip in the reckoning while counting the 8's on the 192 scale.

The reader will therefore remember,—

1. That in working out these 4 to 1 patterns we shall always use the 120 scale.

2. That in adjusting “All at Centre” the Eccentric Chuck is to be squared upright, with the Adjusting Stop in the 120 hole.

3. That instead of setting Lathe at 144—96, we shall always set it at 90—96.

4. And that 30—12 will be used in feeling for the edge of the wood, or in counting for the point of the loop instead of 48 as formerly.

We are now ready to begin the series.

#### FOUR-LOOPEd FIGURE.

Class 1. Back of Loops beyond Centre.

#### PATTERN 41.

*Four-Looped Figure, Doubled and Ornamented.*

“All at Centre.”

|          |                     |
|----------|---------------------|
| Scale, { | { Instrument,       |
| 120 ; }  | { Eccentric Cutter. |

Set Lathe at D.P. 90, E.C.W. 96.

Then, Eccentric Chuck 4 (four) turns 2 (two) divisions forward.

Slide-rest ..... 6 (six) turns forward.

Cutter ..... 6 (six) divisions forward.

Begin at 90—96, and count all round at 5 to 1.

## To double pattern.

Set Lathe at 90—12, and cut all round again at 5 to 1.

*Note.* If you wish to make this pattern very brilliant, take out the double-angle tool, and put in a single-angle tool of about  $10^{\circ}$  (point to left). Set it to cut a small dot, and work the pattern round again, beginning first at 90—12, and next at 90—96, taking care to omit (or blind cut) all those cuts where the former circles cross.

As the enlarging of these patterns is accomplished by *moving the Slide-rest alone*, the border will be cut as follows,—Turn cutter forward 2 (two) divisions, to slightly enlarge the circle. Set Lathe at 15—21, and turn forward Slide-rest till Cutter

|          |             |                                        |
|----------|-------------|----------------------------------------|
|          | D.P. E.C.W. | would cut into circle of former        |
| Begin at | 15—21       | pattern, and then cut as follows, at   |
| End at   | 45—27       | 5 to 1 each cut. Having cut these      |
| Begin at | 15—33       | circles, reduce Cutter to 2 divisions, |
| End at   | 45—39       | and use the table again in cutting     |
| Begin at | 15—45       | the dots in the centre of each of      |
| End at   | 45—51       | the border circles.                    |

Now, to fill up the blank spaces still left between the borders, proceed thus,

“All at Centre.”

|          |       |                                                                                                                                                                     |
|----------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Begin at | 15—81 | Set Lathe at 120—6 ; turn forward (or down) Ecc. Chuck 10 turns ; turn out Cutter 2 divisions, and cut the small circles at 6, 18, 30, 42, &c. Then turn out Cutter |
| End at   | 45—87 |                                                                                                                                                                     |
| Begin at | 15—93 |                                                                                                                                                                     |
| End at   | 45— 3 |                                                                                                                                                                     |
| Begin at | 15— 9 |                                                                                                                                                                     |
| End at   | 45—15 |                                                                                                                                                                     |

5 more divisions, or so as the circle would just touch the 2 nearest dots, and cut round again at 6, 18, 30, 42, &c., when the pattern is finished.

---

### 2d-Class Loops.

Backs of Loops meeting over Centre.

2d-Class Loops may be cut in dots, at about E. Ch. 4 to Slide-rest 4, or at 5 to 5, where small horizontal ellipses are used, but there is no need to give illustrations.

### PATTERN 42.

*2d-Class Loops in large Ellipses Horizontal.*

“All at Centre.”

|          |                             |
|----------|-----------------------------|
| Scale, { | { Instrument,               |
| 120 ; }  | { Elliptical Cutting Frame. |

Then,

Ecc. Chuck 4·5 (four turns five divisions) forward.

Slide-rest . 4·5                    „                    „                    „

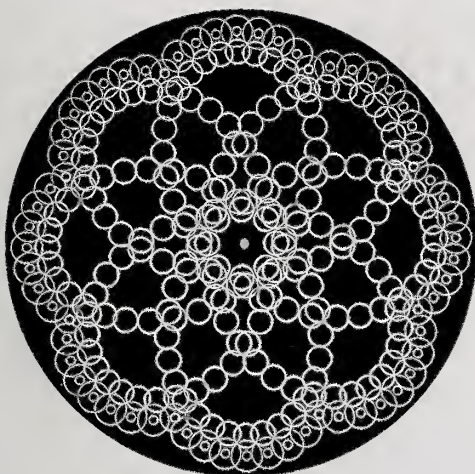
Flange..... 8 (eight) divisions forward.

Cutter..... 2 (two) turns.

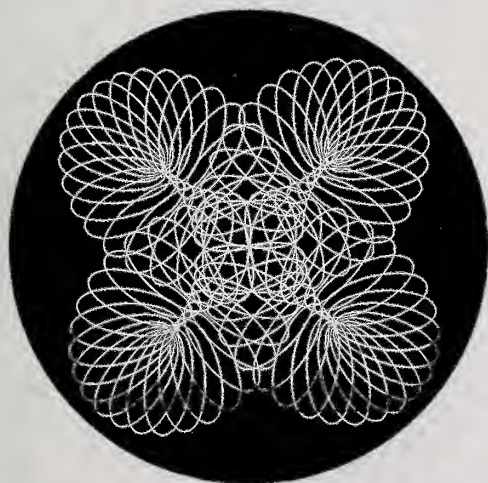
Adjustment  $39\frac{1}{2}$  (thirty-nine and a half) turns.

Set Lathe at 90—96, and cut all round at 5 to 1, *except* at 90—96 ; 90—24 ; 90—48 ; and 90—72 ; that is, do not cut whenever the Division-plate stands at 90. By leaving out these 4 cuts, which are exactly over centre, a pattern is made round the

*Pattern 41.*



*Pattern 42.*





centre, and it does not look crowded ; but this is a very beautiful pattern when cut right through, without any blind cuts.

*Note.* This pattern is brilliant and beautiful, whether cut large or small. I have cut it on African thorn one-half this size, and it was most effective.

---

### 3d-Class Loops.

Back of Loops short of Centre.

### PATTERN 43.

*3d-Class Loop in Horizontal Ellipses.*

“ All at Centre.”

|          |                             |
|----------|-----------------------------|
| Scale, } | { Instrument,               |
| 120 ; }  | { Elliptical Cutting Frame. |

Then, Eccentric Chuck 6 (six) turns forward.

Slide-rest.....  $2\cdot2\frac{1}{2}$  (two turns two & a half divisions) forward.

Then, Flange..... 8 (eight) divisions.

Cutter ..... 2 (two) turns.

Adjustment  $39\frac{1}{2}$  (thirty-nine & a half) turns.

Set Lathe at 90—96, and cut all round at 5 to 1.

---

## PATTERN 44.

*3d-Class Loops in Vertical Ellipses (or Square in Ellipses).*

“ All at centre.”

|          |                             |
|----------|-----------------------------|
| Scale, } | { Instrument,               |
| 120 ; }  | { Elliptical Cutting Frame. |

Then, Flange..... 8 (eight) divisions.

Cutter..... 2 (two) turns.

Adjustment 8 (eight) divisions.

Then, Ecc. Chuck  $8\frac{1}{2}$  (eight & a half) turns forward.

Slide-rest .  $2\frac{1}{4}$  (two & a quarter) turns forwd.

Set Lathe at 90—96, and cut all round at 5 to 1.

Outside Ellipses.—“ All at Centre.”

To find size of ellipses I measured the length and breadth of one of the spaces outside of the pattern ; and, after allowing for a margin, I made the length  $10\frac{1}{2}$  tenths, and breadth  $4\frac{1}{2}$ . This made the sum 15 and the difference 6, which, when divided by 4, each gave 3·75 or 3·8, and 1·5 for Cutter and Flange.

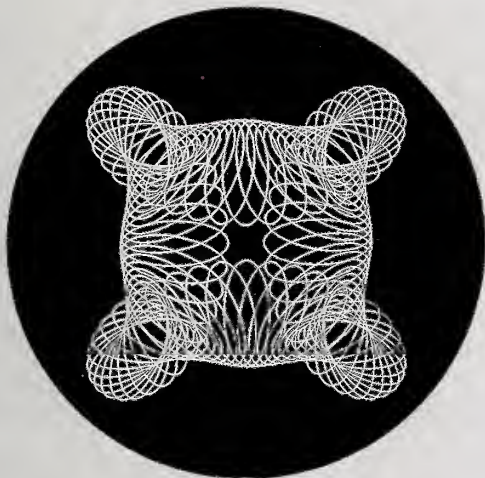
So, Flange... 15 divisions (or one tenth & a half).

Cutter... 3·8 (three) turns (eight) divisions.

Adjust. . 15 divisions (or 3 turns 3 divisions).

Then set Lathe at 90—96 ; turn forward Slide-rest till ellipse would cut at outside, as in pattern ; and, if any adjustment is required, cut hair stroke, and then adjust with *Stop*: but in this pattern I found none necessary.

*Pattern 43.*



*Pattern 44.*





Leave stop in 90 hole, and cut at E.C.W. 96—24—48—72.

Then,

Turn back Cutter 4 divis. and Slide-rest 4 divis. and cut again.

” ” 3 ” ” 3 ” and cut again.

” ” 2 ” ” 2 ” and cut again.

After this turn back 2 divisions each time as often as you please.

### PATTERN 45.

*Beautiful Border Pattern from last Pattern, or  
“Square in Ellipses.”*

*Note.* This pattern is simply the *angle* of the “Square in Ellipses” worked over 12 times.

“All at Centre.”

|          |                             |
|----------|-----------------------------|
| Scale, { | { Instrument,               |
| 120 ; }  | { Elliptical Cutting Frame. |

Then, Flange ..... 6 (six) divisions.

Cutter .....  $1\frac{1}{2}$  (one and a half) turns.

Adjustment 6 (six) divisions, or  $1\frac{1}{2}$  turns.

Then, Eccentric Chuck 7 (seven) turns forward.

Slide-rest..... 2 (two) turns.

Then set Lathe, and cut as follows, at 5 to 1 each cut,—

|        |                |  |       |                 |
|--------|----------------|--|-------|-----------------|
| 1st. { | Begin at 115—5 |  | 2d. { | Begin at 115—13 |
|        | End at 65—19   |  |       | End at 65—27    |

|        |                 |         |                 |
|--------|-----------------|---------|-----------------|
| 3d. {  | Begin at 115—21 | 8th. {  | Begin at 115—61 |
|        | End at 65—35    |         | End at 65—75    |
| 4th. { | Begin at 115—29 | 9th. {  | Begin at 115—69 |
|        | End at 65—43    |         | End at 65—83    |
| 5th. { | Begin at 115—37 | 10th. { | Begin at 115—77 |
|        | End at 65—51    |         | End at 65—91    |
| 6th. { | Begin at 115—45 | 11th. { | Begin at 115—85 |
|        | End at 65—59    |         | End at 65— 3    |
| 7th. { | Begin at 115—53 | 12th. { | Begin at 115—93 |
|        | End at 65—67    |         | End at 65—11    |

The centre pattern is common counting. “All at Centre.” Then, Flange, 10 divisions; Cutter, 2 turns 9 divisions; Adjustment, *None*. Turn forward Slide-rest till Cutter cuts ellipse at or *just beyond* centre knob; then cut all round at all the 6’s on the Eccentric Chuck-wheel—thus, 96, 6, 12, 18, 24, &c.

### PATTERN 46.

*Double Four-Looped Pattern in small Horizontal Ellipses (afterwards doubled, or cut again).*

“All at Centre.”

|          |                             |
|----------|-----------------------------|
| Scale, { | { Instrument,               |
| 120 ;}   | { Elliptical Cutting Frame. |

Then, Flange.....  $2\frac{1}{2}$  (two & a half) divisions forwd.

Cutter ..... 10 (ten) divisions forward.

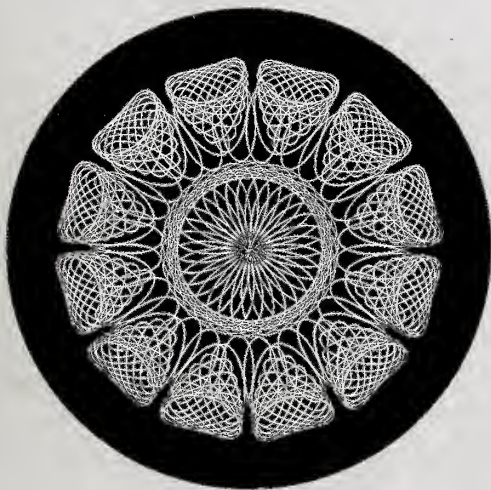
Adjustment 38 (thirty-eight) turns, and  $\frac{1}{2}$  a division.

Then,

Ecc. Chuck 5 (five) turns 5 (five) divisions forward.

Slide-rest . 5 (five) turns 4 (*four*) divisions forwd.

*Pattern 45.*



*Pattern 46.*





Begin at 95—1, and cut all round at 5 to 1, taking care to leave out (or cut blind at) 90—96, 90—24, 90—48, and 90—72.

In order to double the loops, begin again at 95—13, and cut all round again at 5 to 1, taking care to cut blind at 90—12, 90—36, 90—60, and 90—84.

Now to Double the Ellipses.

Set Lathe at 30—12 (as here the pattern is clear).

Then,

Turn *back* Cutter... 3 (three) div. (mind loss of time)

„ Slide-rest 3 (three) divisions „

and adjust to cut into former cut, if necessary.

Then set Lathe as follows, and cut at 5 to 1 each cut,—

|        |                 |        |                 |
|--------|-----------------|--------|-----------------|
| 1st. { | Begin at 100—2  | 5th. { | Begin at 100—50 |
|        | End at 80—22    |        | End at 80—70    |
| 2d. {  | Begin at 100—14 | 6th. { | Begin at 100—62 |
|        | End at 80—34    |        | End at 80—82    |
| 3d. {  | Begin at 100—26 | 7th. { | Begin at 100—74 |
|        | End at 80—46    |        | End at 80—94    |
| 4th. { | Begin at 100—38 | 8th. { | Begin at 100—86 |
|        | End at 80—58    |        | End at 80—10    |

and the pattern is finished.

## PATTERN 47.

*Four Interior Loops, forming an Ornamented Jewel.*

*Note.* These, like the former interior loops, are executed by counting the Division-plate *backwards*,



(two) divisions, and then set Lathe, and cut as follows, always minding to count Division-plate backwards,—

|    |   |          |       |  |    |   |          |        |
|----|---|----------|-------|--|----|---|----------|--------|
| 1. | { | Begin at | 50—8  |  | 3. | { | Begin at | 50—56  |
|    |   | End at   | 10—16 |  |    |   |          | End at |
| 2. | { | Begin at | 50—32 |  | 4. | { | Begin at | 50—80  |
|    |   | End at   | 10—40 |  |    |   |          | End at |

The pattern as it now stands is remarkably brilliant, and might well be let alone; but we will proceed to ornament it.

#### The Dots inside Back of Loops.

Reduce Cutter to 2 divisions to cut a dot. Set Lathe at 30—12 (or middle cut of back of loop), and turn forward Slide-rest until Cutter would cut a dot just inside the circle (*vide* Pattern). Then set Lathe at 50—8, and cut the dots by last table.

#### The Border of Leaves.

Take out Eccentric Cutter, put in Elliptical Cutting Frame, and adjust height of tool by Standard, and set square to wood.

Then, Flange ..... 8 (eight) divisions.

Cutter ..... 9 (nine) divisions.

Adjustment 8 divisions, or 2 turns +  $37\frac{1}{2}$   
turns =  $39\frac{1}{2}$  turns.

Set Lathe at 30—12, and turn forward Slide-rest till one end of the narrow ellipse (almost a straight line) would just touch edge of circle at back of loop (*vide* Pattern); and then set Lathe at 50—8, and cut round by last table.

Now turn back Flange 2 divisions, and Adjustment 2 divisions, and cut round again by table, beginning at 50—8, &c.

Now turn back Flange 2 divisions, Adjustment 2 divisions, and *Slide-rest* 2 divisions, and cut round again by table.

Now turn back again as before Flange 2, Adjustment 2, Slide-rest 2, but in *counting* leave out first and last cut of each *set*: thus, begin at 45—9 (instead of 50—8), and end at 15—15 (instead of 10—16).

Now turn back again Flange 2, Adjustment 2, Slide-rest 2, and count again as last time, and the Border is done.

*Note.* By *not* turning back *Slide-rest* the *first time* the Flange and Adjustment were turned back 2 divisions each, we obtain the *little stalk to the leaf*, which gives great lightness.

### Centre Pattern.

“ All at Centre.”

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Set Lathe at 90—12.

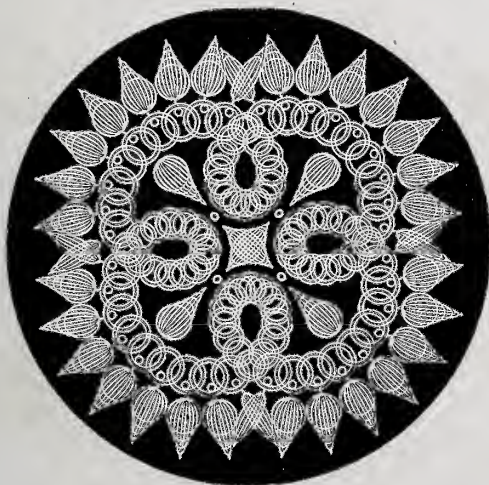
Then set Flange at 8 divisions, Cutter 9 divisions, Adjustment 8 divisions; try hair stroke, and if any adjustment is needed, adjust by *Stop*. Keep *Stop* at 90, and cut at E.C.W. 12 and 36 (single counting).

Turn back Flange and Adjustment 2 divisions each, and cut again at 12 and 36.

Turn back again, and cut again.

Turn back again, and cut again, and the Middle Pattern is finished.

*Pattern 47.*



*Pattern 48.*





### The Four Balloons.

Turn out Flange to 8 divisions and Adjustment to 8 divisions.

Set Lathe at 120—12.

Turn forward (or down) Eccentric Chuck until the Cutter would cut the long narrow ellipse near to middle circle of back of loop (*vide* Pattern). Then, keeping Stop at 120, cut at E.C.W. 12—36, 60—84, and for each subsequent cut turn back Flange 2 divisions, turn back Adjustment 2 divisions, and turn forward Eccentric Chuck 2 divisions, and cut again at 12—36, 60—84, till Flange and Adjustment again stand at 0, when the Balloons are finished.

Now turn back Cutter to 2 divisions, leaving Flange and Adjustment at 0. Turn back Eccentric Chuck till Cutter comes to exact spot where the loops approach nearest, and cut the 4 dots at 12—36, 60—84 (minding to make any necessary adjustment *by the Stop*), and the pattern is finished.

---

### ON SQUARE PATTERNS.

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The Square Patterns follow the same general rules as other polygons.

The peculiar ratio required to make the sides perfectly straight is Eccentric Chuck 8 turns to Slide-rest 1 turn.

The true ratio for Double-counting is, Division-plate 4 to Eccentric Chuck 1, which on the 192 Scale would be 8 to 1, and on the 120 Scale (which we use) 5 to 1.

When the Lathe is set at 90—96, the first cut is *the middle cut* in the *straight side* of the square, and one complete revolution of the Division-plate completes one angle and two  $\frac{1}{2}$ -sides of the square.

The following table gives the ratio required for each different size of square, as the reader must bear in mind, that in enclosing one square within another the Slide-rest can no longer be used alone, as in Ellipses and Looped Figures.

*Table of Ratios for Squares.*

| Eccentric Chuck. | Slide-rest.                                         |
|------------------|-----------------------------------------------------|
| 10 turns .....   | $12\frac{1}{2}$ divisions, or $1\frac{1}{4}$ turns. |
| 8 turns .....    | 10 divisions, or 1 turn.                            |
| 6 turns .....    | $7\frac{1}{2}$ divisions, or $\frac{3}{4}$ turn.    |
| 4 turns .....    | 5 divisions, or $\frac{1}{2}$ turn.                 |
| 2 turns .....    | $2\frac{1}{2}$ divisions, or $\frac{1}{4}$ turn.    |

*Note.* Each of these is in the ratio of 8 to 1.

We will now proceed to the illustrations.

PATTERN 48.

*Three Squares, one within the other.*

“All at centre.”

|                                                  |                |                                  |
|--------------------------------------------------|----------------|----------------------------------|
| Scale, }                                         |                | { Instrument,                    |
| 120 ; }                                          |                | { Eccentric Cutter.              |
| Then, Eccentric Chuck                            | 10             | (ten) turns forward.             |
| Slide-rest .....                                 | $1\frac{1}{4}$ | (one & a quarter) turns forward. |
| Cutter .....                                     | $3\frac{1}{2}$ | (three and a half) divis.        |
| Set Lathe at 90—96, and cut all round at 5 to 1. |                |                                  |

## 2d Square.

Turn back      Ecc. Chuck... 2 (two) turns (or to  
8 turns).

Slide-rest .....  $\frac{1}{4}$  (one quarter) turn  
(or to 1 turn).

Turn forward Cutter to ..... 10 divisions (or to fit  
as in pattern).

Set Lathe again at 90—96, and cut all round at  
5 to 1.

## 3d Square.

Turn back      Ecc. Chuck... 4 (four) turns (or to  
4 turns).

Slide-rest ..... 5 (five) divisions (or  
to 5 divisions).

Turn forward Cutter ..... 2 turns 1 division (or  
to fit as in pattern).

Set Lathe again at 90—96, and cut all round at  
5 to 1, and the pattern is finished.

## PATTERN 49.

*One Square within another, the Outer Square cut  
twice over.*

“All at Centre.”

|          |                     |
|----------|---------------------|
| Scale, { | { Instrument,       |
| 120 ; }  | { Eccentric Cutter. |

Then, Ecc. Chuck 9 (nine) turns forward.

Slide-rest... 1 (one) turn  $1\frac{1}{4}$  (one and a  
quarter) divisions.

Cutter ..... 2 (two) whole turns forward.

Set Lathe at 90—96, and cut all round at 5 to 1.

## Smaller Circles.

Reduce Cutter 5 (five) divisions, set Lathe at 90—96, and cut all round again.

## Inner Square.

Turn back Eccentric Chuck 4 (four) turns.

Slide-rest..... 5 (five) divisions.

Cutter ..... 3 (three) divisions.

Set Lathe at 90—96, and cut all round at 5 to 1.

## PATTERN 50.

*Square in Shells (thick and thin cuts), with an Ornamented Centre.*

“ All at Centre.”

Scale,}  
120 ;}

{ Instrument,  
{ Eccentric Cutter.

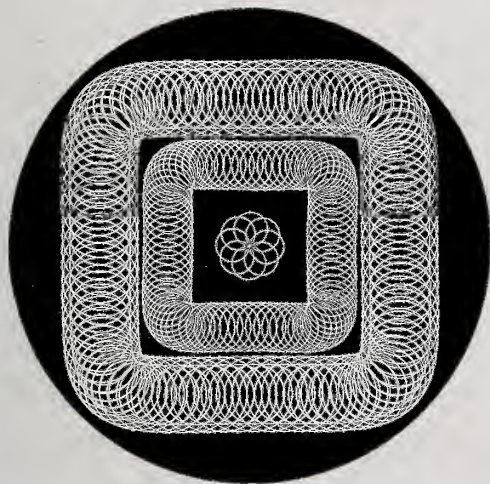
Then, Eccentric Chuck 9 (nine) turns forward.

Slide-rest..... 1 (one) turn  $1\frac{1}{4}$  (one & a quarter) divisions forw.

Cutter ..... 2 (two) turns 4 (four) divisions forward.

Set Lathe at 90—96, and prepare for thick and thin cut. 1st. By making a mark with Cutter on the *outside* edge of the circle. 2d. By unclamping Slide-rest and throwing back the Left, guided by the T-square. 3d. By again clamping Slide-rest and moving back Slide-rest screw till Cutter cuts again

*Pattern 49.*



*Pattern 50.*





exactly in the old *mark*. Then prepare Cutter for turning back without loss of time, and cut round by Table D. (*vide* Note 17), or cut all round, counting 20 to 4 for each cut.

Then, turn back Eccentric Chuck 4 (four) divisions.  
 Slide-rest.....  $\frac{1}{2}$  (half) division.  
 Cutter .....  $3\frac{1}{2}$  (three & a half)  
 divisions, and cut round again by Table D.

Then, turn back Eccentric Chuck 2 (two) divisions.  
 Slide-rest.....  $\frac{1}{4}$  (one quarter) di-  
 vision.  
 Cutter .....  $1\frac{3}{4}$  (one and three-  
 quarters) divisions, and cut round again by Table D.

Repeat this until four cuts are finished.

Then for Square with curved sides round centre.

“All at Centre.”

---

Then, Eccentric Chuck 4 (four) turns 5 (five)  
 divisions forward.  
 Slide-rest..... 1 (one) turn 3 (three)  
 divisions forward.\*  
 Cutter ..... 1 (one) whole turn.

Cut all round at 5 to 1, setting Lathe at 90—96. The circles in the centre and at the sides and angles are simple counting.

*Note.* These squares with thick and thin cuts are very curious. The reader will remark that the first cut at 90—96 has the thick stroke *outside*, while the

\* Or, about  $7\frac{1}{2}$  divisions more than is required for a square with straight sides.

cut at the angle (30—12) has the thick stroke *inside*, and by the time we arrive at 90—24, the thick stroke is again outside, the position of the thick part of the cut being perpetually changed, owing to the peculiar kind of rotation to which the *wood* is subjected by the process of Double-counting. The reader has, doubtless, remarked the manner in which the *Ellipse* rotates in many of the patterns, but the rotation (or apparent rotation) of the circle can only be made visible by means of a thick and thin stroke.

### PATTERN 51.

*Square Pattern in Dots, surrounded by a Square in Thick and Thin Cuts.*

“All at Centre.”

Scale, {  
120 ; }

{ Instrument,  
{ Eccentric Cutter.

*Note.* As this figure is cut in *dots*, put in a double-angle tool to find *centre*, and then change it for a single-angle tool to cut the pattern.

*Note* also, in these dot patterns, the dots of the second row are all intermediate, or between those of the first row ; it is therefore necessary to count 10 to 2, instead of 5 to 1 ; each row consisting of only 48 cuts : thus the first row begins at 90—96, and proceeds thus : 90—96, 100—2, 110—4, 120—6, 10—8, 20—10, 30—12 ; while the second row begins at 95—1 and proceeds thus : 95—1, 105—3, 115—5, 5—7, 15—9, 25—11, &c.

We will now proceed with the pattern.

Inner Row. Eccentric Chuck 4 (four) turns forward.

Slide-rest .....  $\frac{1}{2}$  (one half) turn forw.

Cutter (single-angle tool) set to cut a small dot.

Set Lathe at 90—96, and cut at 10 to 2 all round.

2d Row. Turn forward Ecc. Chuck 6 (six) divisions.

Slide-rest...  $\frac{3}{4}$  (three-quarters)  
division.

Set Lathe at 95—1, and cut all round at 10 to 2.

3d Row. Turn forward Ecc. Chuck 6 (six) divisions.

Slide-rest...  $\frac{3}{4}$  (three-quarters)

division, and count as laid down below for 3d Row,  
and for each subsequent row turn forward Eccentric  
Chuck and Slide-rest as before, and count as laid  
down below :—

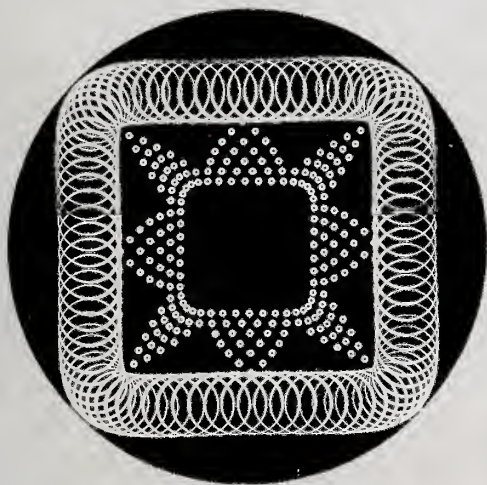
| 3d Row. | 4th Row. | 5th Row. | 6th Row. | 7th Row. |
|---------|----------|----------|----------|----------|
| 70—92   |          |          |          |          |
| 80—94   | 75—93    | 80—94    | 85—95    | 90—96    |
| 90—96   | 85—95    | 90—96    | 95— 1    |          |
| 100— 2  | 95— 1    | 100— 2   |          |          |
| 110— 4  | 105— 3   |          |          |          |
| 10— 8   |          |          |          |          |
| 20—10   | 15— 9    | 20—10    | 25—11    | 30—12    |
| 30—12   | 25—11    | 30—12    | 35—13    |          |
| 40—14   | 35—13    | 40—14    |          |          |
| 50—16   | 45—15    |          |          |          |
| 70—20   |          |          |          |          |
| 80—22   | 75—21    | 80—22    | 85—23    | 90—24    |
| 90—24   | 85—23    | 90—24    | 95—25    |          |
| 100—26  | 95—25    | 100—26   |          |          |
| 110—28  | 105—27   |          |          |          |

| 3d Row. | 4th Row. | 5th Row. | 6th Row. | 7th Row. |
|---------|----------|----------|----------|----------|
| 10—32   |          |          |          |          |
| 20—34   | 15—33    | 20—34    |          |          |
| 30—36   | 25—35    | 30—36    | 25—35    | 30—36    |
| 40—38   | 35—37    | 40—38    | 35—37    |          |
| 50—40   | 45—39    |          |          |          |
| 70—44   |          |          |          |          |
| 80—46   | 75—45    | 80—46    |          |          |
| 90—48   | 85—47    | 90—48    | 85—47    | 90—48    |
| 100—50  | 95—49    | 100—50   | 95—49    |          |
| 110—52  | 105—51   |          |          |          |
| 10—56   |          |          |          |          |
| 20—58   | 15—57    | 20—58    |          |          |
| 30—60   | 25—59    | 30—60    | 25—59    | 30—60    |
| 40—62   | 35—61    | 40—62    | 35—61    |          |
| 50—64   | 45—63    |          |          |          |
| 70—68   |          |          |          |          |
| 80—70   | 75—69    | 80—70    |          |          |
| 90—72   | 85—71    | 90—72    | 85—71    | 90—72    |
| 100—74  | 95—73    | 100—74   | 95—73    |          |
| 110—76  | 105—75   |          |          |          |
| 10—80   |          |          |          |          |
| 20—82   | 15—81    | 20—82    |          |          |
| 30—84   | 25—83    | 30—84    | 25—83    | 30—84    |
| 40—86   | 35—85    | 40—86    | 35—85    |          |
| 50—88   | 45—87    |          |          |          |

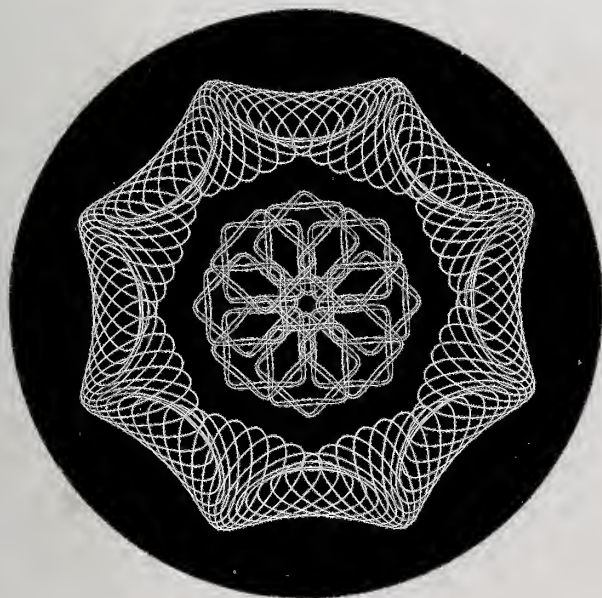
Now for Square in thick and thin cuts.

“All at Centre,” and change Tool for a double-angle one.

*Pattern 51.*



*Pattern 52.*





Then, Ecc. Chuck  $9\frac{1}{2}$  (nine and a half) turns forw.

Slide-rest . . 1 (one) turn 2 (two) divisions  
forward.

Cutter ..... 1 (one) turn 6 (six) divisions, or  
till it reaches to extreme dot at 90—96.

Set Lathe at 90—96, make mark on *inside* of  
circle, and arrange for thick and thin cut, as laid  
down in last pattern, only the thick stroke to be on  
inside of circle, and the right of the Slide-rest to be  
thrown back.

Then set Lathe at 90—96, and cut all round at  
5 to 1.

## PATTERN 52.

*Octagon in Ellipses, Ratio 4 to 1, with Ornamented  
Centre.*

This pattern is worked on the same principle as  
Pattern 40. The adjustments must be most care-  
fully made, and the Slide-rest must on no account be  
moved after the adjustment at true centre.

“All at Centre” (most carefully).

|          |                             |
|----------|-----------------------------|
| Scale, { | { Instrument,               |
| 120 ; }  | { Elliptical Cutting Frame. |

Then, Eccentric Chuck 10 (ten) turns forward.

Slide-rest *not to be moved*.

Then, Flange..... 8 (eight) divisions forw.

Cutter ..... 2 (two) whole turns forw.

Adjustment..... 8 (eight) divisions.

Set Lathe at 90—96, and cut all round at 5 to 1.

Central Squares. (These are simple counting.)

Take out 2-to-1 train of wheels and put in 4-to-1 train of wheels ; try tool by Standard, and then set.

“ All at Centre ” carefully.

---

Set Lathe at 120—96.

Then, Flange..... 24 (twenty-four) divisions forw.  
 Cutter ..... 3 (three) divisions forward  
 (with care).

Adjustment  $5\frac{1}{2}$  turns +  $18\frac{3}{4}$  turns =  $24\frac{1}{4}$   
 (twenty-four and a quarter) turns. *Turn forward*  
*Slide-rest* till angle of square is just *beyond* centre,  
 as in Pattern.

Cut round at all the 12's on the Eccentric Chuck-wheel alone : thus, 96 ; 12 ; 24 ; 36 ; 48 ; 60 ; 72 ; 84.

Now, mind “ loss of time,” and  
 Turn back Flange.....  $2\frac{1}{2}$  divisions.

Cutter.....  $\frac{1}{4}$  division.

Adjustment 2 divisions, and cut all round  
 again.

Now, turn back Adjustment  $18\frac{3}{4}$  turns, and cut  
 all round again.

Lastly, turn *forward* Flange.....  $2\frac{1}{2}$  divisions.

Cutter .....  $\frac{1}{4}$  divis. (mind  
 loss of time).

Adjustment 2 divisions, and  
 cut all round again, and the pattern is finished.

ON THE HIGHER POLYGONS.

---

I have now gone carefully through the *best* of the Looped Figures; for when we proceed beyond the square, the number of cuts to a loop diminish so rapidly, that the figures cease to command attention, either for size or beauty; and I would advise the reader to be content with the variety already afforded by the single and double 3 and 4-Looped Figures. At all events, the few loops to be obtained from the higher ratios are not worthy of being illustrated, though they may possibly suit for patterns on backgammon-men or counters. I shall, therefore, now strictly confine myself to the illustration of the higher Polygons as far as the Octagon, which will, I trust, suffice to give the reader such an insight into the manner of producing these figures, as will enable him to pursue his researches further (if so inclined) without my assistance.

---

ON THE PENTAGON.

---

As the number 96 is not divisible by 5, without a remainder, it would be natural to conclude that our Eccentric Chuck-wheel, with its 96 divisions, could not be used to produce a regular Pentagon. But such is not the case. Without attempting to explain the *reason*, I must limit myself to drawing your attention to the *fact*, singular as it is, that by Double-counting on the 192 and 96 wheels a Pentagon can

be produced, which may not only be called true to the eye, but which is susceptible of careful measurement by compasses, without betraying any palpable error. But as the counting is rather laborious, and the Pentagonal figure by no means a general favourite, I have inserted an illustration, and given a table for counting the numbers, more from the curious nature of the subject than on account of the beauty of the figure.

*Table of Adjustments for Pentagons.*

| Eccentric Chuck. | Slide-rest.               |
|------------------|---------------------------|
| 10 turns .....   | $7\frac{1}{2}$ divisions. |
| 8 turns .....    | 6 divisions.              |
| 6 turns .....    | $4\frac{1}{2}$ divisions. |
| 4 turns .....    | 3 divisions.              |
| 2 turns .....    | $1\frac{1}{2}$ divisions. |

---

PATTERN 53.

*Pentagon.*

“All at Centre.”

---

|                          |                                                         |
|--------------------------|---------------------------------------------------------|
| Scale, {                 | { Instrument,                                           |
| 192 ;}                   | { Eccentric Cutter.                                     |
| Then, Eccentric Chuck 10 | (ten) turns forward.                                    |
| Slide-rest.....          | $7\frac{1}{2}$ (seven and a half)<br>divisions forward. |
| Cutter .....             | 1 (one) turn 8 (eight)<br>divisions forward.            |

Set Lathe at 144—96, and count all round *by Table*, at 10 to 1.

## Inside Pentagon.

Turn *back* Ecc. Chuck 4 (four) turns (or to 6 turns).

Slide-rest... 3 (three) divisions (or to  $4\frac{1}{2}$  divisions).

Cutter ..... 3 (three) divisions (or to 1 turn 5 (five) divisions).

Set Lathe at 144—96, and cut all round again by Table at 10 to 1.

*Table of Counting for Pentagon at 10 to 1.*

| D.P. E.C.W. | D.P. E.C.W. | D.P. E.C.W. | D.P. E.C.W. | D.P. E.C.W. |
|-------------|-------------|-------------|-------------|-------------|
| 144—96      | 152—20      | 160—40      | 168—60      | 176—80      |
| 154— 1      | 162—21      | 170—41      | 178—61      | 186—81      |
| 164— 2      | 172—22      | 180—42      | 188—62      | 196 or      |
| 174— 3      | 182—23      | 190—43      | 198 or      | 4—82        |
| 184— 4      | 192—24      | 200 or      | 6—63        | 14—83       |
| 194 or      |             | 8—44        | 16—64       | 24—84       |
| 2— 5        | 10—25       | 18—45       | 26—65       | 34—85       |
| 12— 6       | 20—26       | 28—46       | 36—66       | 44—86       |
| 22— 7       | 30—27       | 38—47       | 46—67       | 54—87       |
| 32— 8       | 40—28       | 48—48       | 56—68       | 64—88       |
| 42— 9       | 50—29       | 58—49       | 66—69       | 74—89       |
| 52—10       | 60—30       | 68—50       | 76—70       | 84—90       |
| 62—11       | 70—31       | 78—51       | 86—71       | 94—91       |
| 72—12       | 80—32       | 88—52       | 96—72       | 104—92      |
| 82—13       | 90—33       | 98—53       | 106—73      | 114—93      |
| 92—14       | 100—34      | 108—54      | 116—74      | 124—94      |
| 102—15      | 110—35      | 118—55      | 126—75      | 134—95      |
| 112—16      | 120—36      | 128—56      | 136—76      | —           |
| 122—17      | 130—37      | 138—57      | 146—77      | 144—96      |
| 132—18      | 140—38      | 148—58      | 156—78      | again.      |
| 142—19      | 150—39      | 158—59      | 166—79      |             |

N.B. This Table should be copied out, especially if you want any 5-looped figures.

## ON THE HEXAGON.

*Table of Adjustments for Hexagons.*

| Ecc. Chuck.   | Slide-rest.               |
|---------------|---------------------------|
| 9 turns ..... | $4\frac{1}{2}$ divisions. |
| 8 turns ..... | 4 divisions.              |
| 7 turns ..... | $3\frac{1}{2}$ divisions. |
| 6 turns ..... | 3 divisions.              |
| 5 turns ..... | $2\frac{1}{2}$ divisions. |
| 4 turns ..... | 2 divisions.              |
| 2 turns ..... | 1 division.               |

## PATTERN 54.

*Hexagon.*

“All at Centre.”

|          |                     |
|----------|---------------------|
| Scale, { | { Instrument,       |
| 192 ; }  | { Eccentric Cutter. |

## Inner Hexagon.

Then, Eccentric Chuck 6 (six) turns forward.

Slide-rest..... 3 (three) divisions forward.

Cutter ..... 1 (one) turn forward.

Set Lathe at 144—96, and count all round at 12 on Division-plate to 1 on Eccentric Chuck-wheel. (This is very easy counting.)

## Outside Hexagon.

Turn forward Ecc. Chuck 3 (three) turns.

„ Slide-rest .  $1\frac{1}{2}$  (one division & a half).

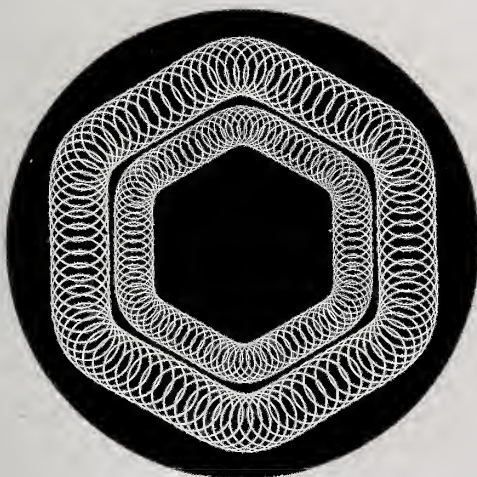
„ Cutter ..... 5 (five) divisions.

Set Lathe again at 144—96, and cut all round at 12 to 1.

*Pattern 53.*



*Pattern 54.*





*Note 1.* As a general rule for *all* these polygonal figures, it is better to begin with the interior pattern, and then proceed to the outer one, as in so doing you have to turn *forward* all the Adjustments, and have nothing to fear from unobserved “loss of time.” This remark applies more especially to the higher Polygons, where the Slide-rest is only turned forward a few divisions, and where *any* “loss of time” would inevitably destroy the straightness of the sides. The only advantage in executing the outer polygon *first*, is when the *size of the wood* happens to be *fixed*, and you wish to make the Polygon as large as the wood will allow.

*Note 2.* Some of the most brilliant of this class of patterns are such as might be executed *within* the spaces which I have left blank in these examples, simply because they are too small to print ; but just try the following one, as an example of what I mean, in the blank centre of the Hexagon you have just cut,—

“ All at Centre.”

---

Then, Ecc. Chuck 3 (three) turns forward.

Slide-rest .  $1\frac{1}{2}$  (one and a half) divisions.

Cutter..... 1 (one) turn, 1 (one) division.

Set Lathe at 144—96, and cut all round at 12 to 1.

The tool should be about  $14^{\circ}$  or  $16^{\circ}$ . Do not cut deeper than just enough to leave no blanks between the cuts. Try alternately at 144—96 and 156—1, till the 2 cuts just come to a sharp edge.

*Note 3.* Although these Polygons with straight sides show both care and skill, and are in themselves

essentially beautiful, still, for the sake of variety, you should not neglect to cut some of these figures with *concave sides*, of which I give a specimen at the end of the book ; they are very graceful, and by no means difficult. The rule is to turn out the Slide-rest *rather more* than is required for straight sides, begin with the inner pattern, and carefully fit the next pattern to the curve you have selected.

---

### ON THE HEPTAGON.

---

#### *Table of Adjustments for the Heptagon.*

| Eccentric Chuck. | Slide-rest.                    |
|------------------|--------------------------------|
| 9 turns .....    | $3\frac{1}{4}$ divisions full. |
| 8 turns .....    | 3 divisions.                   |
| 6 turns .....    | $2\frac{1}{2}$ divisions.      |
| 5 turns .....    | $1\frac{3}{4}$ divisions.      |
| 4 turns .....    | $1\frac{1}{2}$ divisions.      |

### PATTERN 55.

#### *Heptagon.*

The Heptagon, like the Pentagon, is a figure which no one would think could be executed on a 96 wheel ; but so far from this being the case, the reader will perceive from the annexed table that the counting returns to the very figures from which it set out, and no irregularity can be detected in the figure, which is very handsome.

“All at Centre.”

---

Scale, }  
192 ; }

{ Instrument,  
{ Eccentric Cutter.

Then, Ecc. Chuck 9 (nine) turns forward.

Slide-rest .  $3\frac{1}{4}$  (three and a quarter) divisions  
*full* forward.

Cutter..... 2 (two) whole turns forward.

Cut all round at 14 to 1 by Table.

Then set Lathe again at 144—96 ; turn *forward* Cutter  $3\frac{1}{2}$  (three and a half) divisions (or till it just divides the 1st and 2d cut), and cut round again by Table. Then, for inner Heptagon, set Lathe “All at Centre.” Then turn forward Eccentric Chuck 5 (five) turns ; Slide-rest  $1\frac{3}{4}$  (one and three-quarters) divisions ; and Cutter 1 (one) whole turn. Set Lathe again at 144—96, and cut round by Table.

*Table of Counting for the Heptagon.*

| D.P.<br>E.C.W. | D.P.<br>E.C.W. | D.P.<br>E.C.W. | D.P.<br>E.C.W. | D.P.<br>E.C.W. | D.P.<br>E.C.W. | D.P.<br>E.C.W. | D.P.<br>E.C.W. |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| 144—96         | 134—13         | 124—26         | 114—39         | 104—52         | 94—65          | 84—78          | 74—91          |
| 158— 1         | 148—14         | 138—27         | 128—40         | 118—53         | 108—66         | 98—79          | 88—92          |
| 172— 2         | 162—15         | 152—28         | 142—41         | 132—54         | 122—67         | 112—80         | 102—93         |
| 186— 3         | 176—16         | 166—29         | 156—42         | 146—55         | 136—68         | 126—81         | 116—94         |
| 8— 4           | 190—17         | 180—30         | 170—43         | 160—56         | 150—69         | 140—82         | 130—95         |
| 22— 5          | 12—18          | 2—31           | 184—44         | 174—57         | 164—70         | 154—83         | —              |
| 36— 6          | 26—19          | 16—32          | 6—45           | 188—58         | 178—71         | 168—84         | 144—96         |
| 50— 7          | 40—20          | 30—33          | 20—46          | 10—59          | 192—72         | 182—85         | again.         |
| 64— 8          | 54—21          | 44—34          | 34—47          | 24—60          | 14—73          | 4—86           |                |
| 78— 9          | 68—22          | 58—35          | 48—48          | 38—61          | 28—74          | 18—87          |                |
| 92—10          | 82—23          | 72—36          | 62—49          | 52—62          | 42—75          | 32—88          |                |
| 106—11         | 96—24          | 86—37          | 76—50          | 66—63          | 56—76          | 46—89          |                |
| 120—12         | 110—25         | 100—38         | 90—51          | 80—64          | 70—77          | 60—90          |                |

N.B. This Table should be copied out for use.

## OCTAGON.

In cutting Octagons we use the 120 Scale of the Division-plate, and count 10 to 1 on the Eccentric Chuck-wheel, which gives 12 cuts for each side of the figure.

## PATTERN 56.

*One Octagon within Another.*

“All at Centre.”

|          |                     |
|----------|---------------------|
| Scale, { | { Instrument,       |
| 120 ; }  | { Eccentric Cutter. |

Then, Ecc. Chuck 9 (nine) turns forward.

Slide-rest .  $2\frac{1}{4}$  (two and a quarter) divisions forward.

Cutter .....  $2\frac{1}{2}$  (two and a half) turns.

Set Lathe at 90—96, and cut all round at 10 to 1.

Inner Octagon.

“All at Centre” (and change tool).

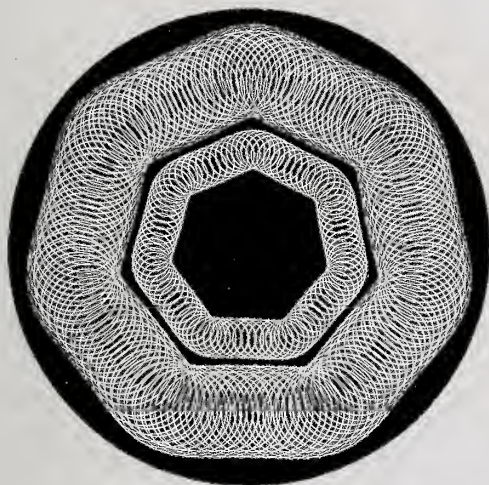
Then, Ecc. Chuck  $4\frac{1}{2}$  turns forward.

Slide-rest .  $1\frac{1}{4}$  divisions.

Cutter ... 1 (one) turn 3 (three) divisions forward.

Set Lathe at 90—96, and cut all round at 10 to 1.

*Pattern 55.*



*Pattern 56.*

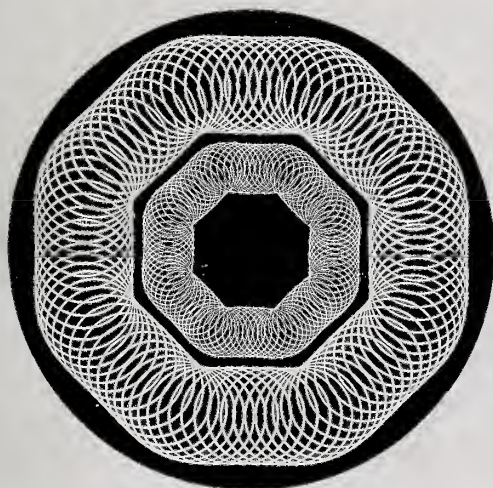




*Table of Adjustments for Octagon.*

| Ecc. Chuck.   | Slide-rest.               |
|---------------|---------------------------|
| 9 turns ..... | $2\frac{1}{4}$ divisions. |
| 8 turns ..... | 2 divisions.              |
| 6 turns ..... | $1\frac{1}{2}$ divisions. |
| 4 turns ..... | 1 division (full).        |
| 2 turns ..... | $\frac{1}{2}$ division.   |

---

 CONCLUSION.
 

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HAVING gone through a long and regular series, beginning with the Ellipse and ending with the Octagon, I here bring my labours to a close; not because the subject is exhausted, but because I trust that I have employed a system by which my readers may have become so well grounded in the practice of "Double-counting" as to act for themselves, without any further assistance from me.

For those who wish to proceed no further than the mere copying of the illustrations furnished in this work, I have provided a number and variety of patterns, which will keep them long, and I hope pleasantly, employed; while to those who may wish to alter or modify the patterns presented to their notice, or to invent new ones for themselves, I have, I trust, given such systematic instruction as will enable them readily to seize upon the various openings which occur for altering, and in many cases

entirely changing the appearance of the Pattern on which they may happen to be employed. And I here bid farewell to my readers, with the earnest hope that, considering the novelty, the extreme beauty, and almost endless variety of the Patterns, no one of them will allow himself to be baffled, at the beginning of his career, by the novel, but I must say trifling, difficulties which he may experience in his first attempts at

*“Double-Counting.”*

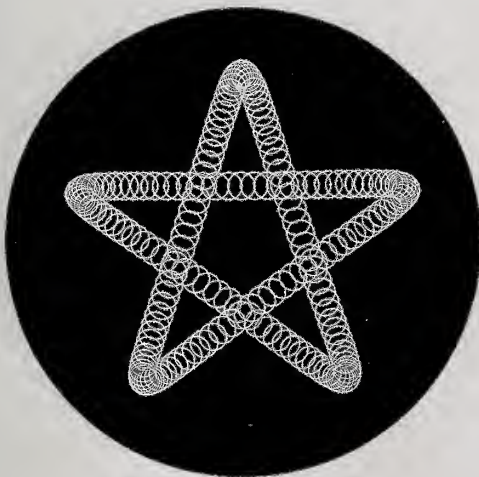
P.S. To give a general idea of what I mean by modifying, altering, and inventing patterns, I append four (Nos. 57, 58, 59, and 60) without any explanations, on which my readers can exercise their ingenuity.

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No. 57.

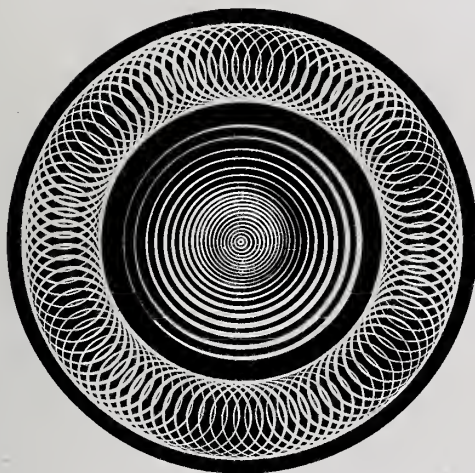


No. 58.





No. 59.



No. 60.





## NOTES.

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### *Note 1, page 5. "Double-Counting."*

The detent of the ratchet-wheel of the Eccentric Chuck in Double-counting will sometimes be above, sometimes below, sometimes on the left side, and sometimes on the right side, as the wheel obeys the singular compound motion communicated to it in this peculiar mode of counting. And it will, at first, require all your ingenuity to determine the best position for your hands, in shifting the detent from one division to another.

A few trials will, however, I hope, soon convince you of what is the best position for your hands in each situation of the detent; and when this is once discovered, take my advice and never change it again; as the more mechanical you become in all the positions required for "*double-counting*," the better for your early chance of success.—N.B. Always keep a piece of white paper on the bed of the Lathe *under* the Eccentric Chuck, to throw up the light.

### *Note 2, page 6. "Brass Standard."*

The brass standard is a pillar about  $7\frac{1}{2}$  inches high and about  $\frac{3}{4}$  of an inch diameter, with a Flange at about  $1\frac{1}{2}$  inches from the lower end, wide enough to make it stand quite firm, and steady when set upright on the bed of the Lathe. It is figured in Plate I. fig. 2, and can easily be made as follows:—Turn a wooden model of *rather* larger dimensions than those set down in the figure, and have a cast in brass taken. Turn the brass true, especially the bottom of the Flange, and, when finished, set it up on the bed of the Lathe, just in front of the popit-head; advance it slowly with your finger, by pushing the Flange carefully

forward till it touches the *point* of the popit-head, when a slight tap behind will leave a mark in the brass. Cluck it again, and with a sharp-pointed tool in the Slide-rest cut a line round, exactly at the place where the point of the popit left a mark, which will be the exact height you require for your Cutter-tool.

*Note 3, page 9. "Loss of time."*

All the graduated screws belonging to a Lathe are liable to an error, technically called "loss of time," the effect of which should be carefully guarded against: for instance, if after turning the Slide-rest *forwards* for a turn or two you require to turn it *back*, you will find that *just* as you commence to do so the screw feels loose, and turns back for 2 or 3 divisions, without moving the tool-box back with itself; this delay in moving the tool-box is called "loss of time," and the mode of guarding against it is to move the screw forward 4 or 5 divisions before you move it the reverse way. Thus, suppose I have been turning *forward*, and having stopped at Division 4, I wish to turn back 4 divisions. I first turn forward to Division 8 or 9, then turn back to the 4th division where I originally was, and then turn back 4 divisions, when the tool-box will also have moved back *exactly* 4 divisions, the "loss of time" having harmlessly taken place while turning back from 9 to 4.

In order to prevent mistakes, I may as well, once for all, state what I mean by turning *forwards* and *backwards*. By *forwards*, I mean turning the screw according to the proper order, or succession of the numbers engraved on it: thus, from 0 to 1, from 1 to 2, from 2 to 3, and so on. By *backwards*, I mean turning the screw in the *reverse* order of the numbers; thus from 0 to 9, from 9 to 8, from 8 to 7, and so on.

*Note 4, page 10. "And Eccentric Cutter 8 divisions."*

I wish to give the reader a caution relative to the numbering of the screw-wheels of the Eccentric and Elliptical Cutters. One turn of the Slide-rest screw is exactly equal to one-tenth of an inch; so is one turn on the Eccentric Chuck; so, also, is one turn on either of the Cutter-screws: but while the Slide-rest and

Eccentric Chuck screw-heads are divided into 10 equal parts, numbered from 1 to 10, the Cutter screw-heads are divided into 5 equal parts, numbered from 1 to 5. Hence the numbers 1, 2, 3, 4, 5 on the Cutter-screw, are severally equal to the numbers 2, 4, 6, 8, 10 on the Slide-rest and Eccentric Chuck screws. Hence, also, what are apparently half-division marks on the Cutter-wheel, are in reality equal to whole divisions on the Slide-rest and Eccentric Chuck-screws, *and must always be used and counted as such*, as in most cases it is of the utmost importance. Thus, suppose you are cutting a shell-pattern, in which you require to use the Slide-rest and Eccentric Cutter together, and for every set of cuts to turn forward 2 divisions on each. If both screws were at 0, the counting would be 1, 2, 3, 4, 5 successively on the Eccentric Cutter, to 2, 4, 6, 8, 10 successively on the Slide-rest; and in *all* cases of setting the Cutter, you must reckon the apparently  $\frac{1}{2}$  divisions on the Cutter as whole ones. Thus, suppose "*All at centre*," and the direction is "Eccentric Cutter 8 divisions forward," you must move the screw-head from 0 to 4; if the direction is "7 divisions," you must move the screw-head to  $3\frac{1}{2}$  divisions; if the direction is " $\frac{1}{2}$  a turn forward," you must move to  $2\frac{1}{2}$  divisions. If the direction is, "move forward 16 divisions," you must move first one whole turn (or 10 divisions), and then from 0 to 3 divisions. All this trouble would have been avoided if the Cutter-wheels had been *marked* just as they are *now*, but had been *numbered* 2, 4, 6, 8, 10, instead of 1, 2, 3, 4, 5.

*Note 5, page 10. "Set Division-plate at 144, and Eccentric Chuck-wheel at 96."*

We will consider these two orders separately.

1st. Why should the Division-plate be set at 144?

Let the reader bear in mind that we are using the 192 scale, and that the Eccentric Chuck has just been set perfectly *perpendicular* with the T-square, the Lathe being set at 192.

Now, if the Eccentric Chuck is perfectly *perpendicular* at 192, it will be perfectly *horizontal* at either 48 or 144 (the first and 3d quarters of 192 scale). Now, if you go to your Lathe, and read the rest of this note with your Lathe before you, you

will find, if you set the Lathe at 48, that the Eccentric Chuck-serew, in moving *forwards*, will carry the wood horizontally *to the right*, whereas we want the wood carried horizontally *to the left*, because, when the Slide-rest is set (as it must be) facing the wood, the motion communicated by the Slide-rest serew to the Cutter when moved *forward* is horizontally *to the left*; we, therefore, set the Division-plate at 144, when, on turning the Eccentric Chuck-wheel *forward*, the wood, like the Cutter, will move horizontally to the left,—which is exactly what we want it to do, for this is the only position of the Eccentric Chuck at which you can watch the progress of the Adjustments, as well as secure the just development of the pattern; for when the Eccentric Chuck is horizontal at 144, the first cut is the exact middle cut in the flat side of all polygonal figures; it is the exact middle cut at the *back of the loop* of all looped figures where the loop is exterior; and it is the centre cut of the *loop itself* in all interior looped figures, and in the Ellipse it is the cut exactly at the left extremity of the minor axis; and when the pattern is finished, and the Lathe set again at 144, the Ellipse is exactly perpendicular. Hence, if you begin at 144, you start from a known point in each description of pattern, which of itself is of no small advantage.

Let the reader now set his Lathe “All at Centre,” and then at 144, and proceed as I shall direct, and he will perceive with what facility he can watch the adjustments.

1st. Turn forward the Eccentric Chuck serew 4 (four) turns, and you will perceive that the little knob in the middle of the wood has been carried horizontally to the left  $\frac{4}{10}$  of an inch.

2d. Turn forward the Slide-rest serew 2 (two) turns, and you will perceive that this movement will approach the tool towards the little knob  $\frac{2}{10}$  of an inch.

3d. Turn forward Slide-rest screw 2 (two) turns more, and you will find the point of the tool again exactly over the little knob; and if you turn forward the Slide-rest screw two turns more, you will find the point of the tool  $\frac{2}{10}$  of an inch beyond, and to the left of, the little knob.

Now these three positions in which you have placed the tool are the three principal positions used when cutting exterior looped figures, and as each position shows the exact spot where

the *back* of each respective loop would be—the first  $\frac{2}{10}$  short of centre, the second exactly over centre, and the third  $\frac{1}{10}$  beyond the centre—you perceive at once the facilities presented to you by this system for *watching* the Adjustments of the pattern you may be copying, or for making new Adjustments in trial patterns, as in the last case you actually see the limits of the space within which the alterations must be made, if you wish to alter the pattern.

Again, in cutting Ellipses one within the other, if you set the Lathe at 144 as soon as the first Ellipse is finished, you plainly see how far you require to move the Slide-rest forward, and can absolutely measure any space you may wish to leave between the two Ellipses.

These instances of the advantages to be obtained by this system are few to what might be mentioned, but it will, perhaps, be better to point out the others as they occur in the body of the work.

#### 2d. Why set Eccentric Chuck-wheel at 96?

As the Eccentric Chuck-wheel only moves one division at a time, there are, of course, many patterns, which you might begin wherever you pleased; but it is best, as a system, to begin *always* at 96, because you constantly require compound patterns, or else patterns which have to coincide with rosettes, borders, &c. &c.; or patterns composed of some part or portion of a regular figure, repeated 4, 6, 8, or even 12 times; and it is clear, that in all these cases beginning at 96 renders the repetitions easy and accurate, as nothing more is required than to take the known divisions of 96, and set the wheel successively at each of them. The rules for these occasions are so simple, that the notice of each which will be given in the body of the work will be quite sufficient.

#### *Note 6, page 21. "Thick and thin cuts."*

To make this rule for thick and thin cuts useful on all occasions, *bear in mind*,—

1st. To adjust your apparatus so as to give the exact spot where you wish the circle to be.

2d. Then make a slight *mark* with the Cutter-tool *on that side* of the circle which is to be *thick*.

3d. Then unclamp the Slide-rest screw, and throw *back* that side of the Slide-rest which is *opposite* to the thick side of the circle, using the T-square at a slight angle.

4th. Then elamp your Slide-rest screw, and having thus fixed the Slide-rest in a slanting position, move the graduated serew-head until the Cutter-tool again enters the mark you made before, when the Adjustment is complete. Should the eut, however, not please your fancy, you can unclamp the Slide-rest serew again, and change the angle; but you must be *sure* to adjust the Cutter-tool again, so that it will again enter exactly into the former eut, or the thin part of the cut will be quite spoilt.

*Note 7, page 22. "Cut all round as laid down in Table A, Variegated Ellipse."*

The manner in which the numbers in Table A (next page) are obtained is very simple. There is an alternation of 5 cuts of the usual 4 to 1, with 4 cuts of 8 to 2, throughout the pattern; and in order to secure the equal distribution of the whole, D.P. 144—E.C.W. 96 is selected as *the middle cut* of the *first five single cuts*.

The series of 5 single euts begins, therefore, at 136—94, or 2 cuts *short* of 144—96; and ends at 152—2, or 2 cuts *beyond* 144—96. Then follow 4 double euts of 8 to 2 each; and then again 5 single euts of 4 to 1; and so on all round the Ellipse.

By this alternation of 5 single euts to 4 double ones you obtain 4 spaces between the single cuts, and 4 spaces also between the double cuts, the 5th single eut being common to both. By this arrangement, also, all the 12's on the Eccentric Chuck-wheel mark the middle cut of the five single euts, and serve as a check to the accuracy of the whole. Thus, 144—96, 192—12, 48—24, 96—36, 144—48, &c. &c., mark the middle eut of the successive series of 5 single euts. With a little care and patience this is not difficult, and the Table here given will serve for many a pretty pattern of this kind, both circular and elliptical; for the circular pattern use the Nos. for the E.C.W. alone.

TABLE A.

*For Variegated or Striped Ellipses.*

|          | D.P. E.C.W. | D.P. E.C.W. | D.P. E.C.W. | D.P. E.C.W. |
|----------|-------------|-------------|-------------|-------------|
| Begin at | 136—94      | 40—22       | 136—46      | 40—70       |
|          | 140—95      | 44—23       | 140—47      | 44—71       |
|          | 144—96      | 48—24       | 144—48      | 48—72       |
|          | 148—1       | 52—25       | 148—49      | 52—73       |
|          | 152—2       | 56—26       | 152—50      | 56—74       |
|          | 160—4       | 64—28       | 160—52      | 64—76       |
|          | 168—6       | 72—30       | 168—54      | 72—78       |
|          | 176—8       | 80—32       | 176—56      | 80—80       |
|          | 184—10      | 88—34       | 184—58      | 88—82       |
|          | 188—11      | 92—35       | 188—59      | 92—83       |
|          | 192—12      | 96—36       | 192—60      | 96—84       |
|          | 4—13        | 100—37      | 4—61        | 100—85      |
|          | 8—14        | 104—38      | 8—62        | 104—86      |
|          | 16—16       | 112—40      | 16—64       | 112—88      |
|          | 24—18       | 120—42      | 24—66       | 120—90      |
|          | 32—20       | 128—44      | 32—68       | 128—92      |

*Note 8, pages 24 and 30.*

Recollect, all these straight lines produced by the Elliptical Cutting-frame must *always* be cut with a very fine-pointed double-angle tool of  $55^{\circ}$  or  $60^{\circ}$ , and should not be cut *deep*, or the beauty of the cut is lost.

*Note 9, page 29. "Turn back Slide-rest to original centre."*

In this instance the centre happens to be untouched, and, therefore, there is no difficulty in setting the tool again to it. But as it often happens that the centre is destroyed or obliterated in cutting the first pattern, and is again required in setting the apparatus for a border, or some other subsequent operation, I *never fail* to set down a memorandum of the Slide-rest centre, either on a bit of waste paper, or on one corner of the paper on which I have written down my proposed Adjustments,—taking care to

make it sufficiently explicit to remind me of the exact position of the old centre. Thus Centre 3, or Centre  $4\frac{1}{2}$ , or Centre  $5\frac{1}{2}$  full, or Centre  $6\frac{3}{4}$  over, &c., with such a memorandum you have only to turn *back* the Slide-rest screw until, by guess, the tool is about  $\frac{1}{10}$  of an inch *beyond* the old centre, and then turn the Slide-rest screw carefully *forward* till it reaches the exact division specified in your memorandum.

*Note 10, page 32. "Large Sea-Hedgehog."*

As these patterns are extremely beautiful I shall give the Adjustments for two smaller ones, which the reader can practise if he likes.

*Adjustments for No. 1 Sea-Hedgehog (no figure).*

"All at Centre."

Scale, }  
192 ; }

{ Instrument,  
{ Eccentric Cutter.

Then, Eccentric Chuck 4 turns forward.

Slide-rest ..... 2 turns forward.

Cutter ..... 3 whole turns forward.

Set Lathe at 144—96, and cut all round at 4 to 1 till 96 cuts are completed.

If you require a border to this pattern, turn back all to centre, then turn forward Eccentric Chuck 1 (one) turn  $9\frac{1}{2}$  (nine and a half) divisions, (or 2 (two) turns will do almost equally well), and set Lathe at 144—96.

Then turn forward Cutter-tool as much as you require for your intended border, and turn forward Slide-rest until the circle cut by Cutter-tool will be full clear of left edge of Hedgehog. Try again with Lathe set at 192—12 (for the reason given in Note 11), then come back to 144—96, and cut all round at 4 to 1, until 96 cuts are completed.

*Adjustments for No. 2 Sea-Hedgehog (no figure), smaller than the last.*

“All at Centre.”

Scale, }  
192 ; }

{ Instrument,  
{ Eccentric Cutter.

Then Eccentric Chuck  $2\frac{1}{2}$  (two and a half) turns forward.

Slide-rest .....  $1\frac{1}{4}$  (one and a quarter) turns forward.

Cutter ..... 2 (two) whole turns.

Set Lathe at 144—96, and cut all round at 4 to 1 until 96 cuts are completed.

I have cut this pattern in African thorn, using a double-angle tool of  $16^\circ$ , and not cutting deeper than *just* enough to make the facets pointed. The effect of this little Sea-Hedgehog is exquisite, but it is too fine to print. (*Note.* I have found it best to cut these patterns with the wood *glued* to the chuck, instead of simply driven on as usual: this is worth your notice.)

After I had cut this pattern, I surrounded it with a border of *thick and thin* circles, with the following Adjustments:—

“All at Centre.”

Then Eccentric Chuck 1 (one) turn,  $2\frac{1}{2}$  (two and a half) divisions forward, then set Lathe at 144—96.

Turn forward Cutter 1 (one) turn, 8 (eight) divisions. Turn out Slide-rest till Cutter would cut a circle clear of centre pattern (try again with Lathe set at 192—12, as per Note 11). Then set Lathe again at 144—96. Make a mark with Cutter-tool, and set Slide-rest *out* to cut a thick-and-thin stroke (*vide* Note 6), and having completed all these Adjustments, cut all round at 4 to 1 until 96 cuts are done, and you will find this a border of singular beauty, which, when turned to the light, shows like watered silk.

*Note 11, page 33. “Variegated Sea-Hedgehog, with border.”*

If you require to surround one of these patterns with a *border*, you must follow a new rule, as my former rule for Concentric

Ellipses no longer holds good, as in these patterns the eccentricity requires to be changed *before* the Slide-rest can be turned forward to produce the border.

Provide yourself with a Gunter's Seale and a fine-pointed pair of compasses, and proceed as follows:—

*Rule.*—Measure the extreme length of the Sea-Hedgehog, and set it down in inches and decimals.

Measure the extreme breadth of the Sea-Hedgehog, and set it down in the same way.

Subtraet extreme breadth from extreme length, and the difference divided by 4 is the required eccentricity in decimals.

Let us first take Pattern 13, and work out the eccentricity required for a border by this rule: thus,—

|                       | in. dec. |
|-----------------------|----------|
| Extremc Length .....  | 2·28     |
| Extremc Breadth ..... | 1·35     |
|                       | <hr/>    |
| Difference .....      | ·93      |

Then decimal ·93 divided by 4 gives decimal  $\cdot 23\frac{1}{4}$ , or two-tenths three and a quarter hundredths, or 2 (two) turns and  $3\frac{1}{4}$  (three and a quarter) divisions—the eccentricity required. Therefore, bring Lathe to “All at Centre;” then turn forward Eccentric Chuck 2 turns  $3\frac{1}{4}$  divisions, and set Lathe at 144—96.

Then turn forward Cutter-tool as much as you may require for the intended border; and having thus turned out the tool, turn forward Slide-rest until the Cutter-tool would cut a circle a little *beyond* the *left* edge of the Sea-Hedgehog. Then set Lathe at 192—12; and if on trial the tool would cut any way *into* the Sea-Hedgehog at this point, turn forward Slide-rest until it cuts just clear.

Then reset Lathe at 144—96, and cut all round at 4 to 1 each cut; and recollect, that this border pattern will cut from left to right again, and will conform in all respects to the *old rule*, because the Slide-rest is again turned out *much* further than the Eccentric Chuck. Note also the reason why I tell you to set Lathe and try Cutter at 192—12.

The outside edge of a Sea-Hedgehog pattern is not *exactly* a true ellipse; but may be described as an ellipse with swelled

shoulders. Now, if you turn to Fig. 3, page 14, you will see that setting the Lathe at 192—12 brings the first shoulder of the Ellipse (No. 2) under the Cutter; so that if the Cutter is made to cut clear *there*, it will be sure to cut clear all round.

I will now work out the eccentricity required for the border of Pattern 14 by this rule; but as many of my readers may not like the trouble of working out this rule, I have taken care to give the eccentricity for each of the smaller Sea-Hedgehog patterns specified in Note 10.

#### Eccentricity of Border to Pattern 14.

Extreme Length ..... 1·86

Extreme Breadth ..... 1·06

Difference .....  $\cdot 8$ ; and decimal  $\cdot 8$

divided by 4 is equal to  $\cdot 2$ , or 2-tenths of an inch, or 2 turns on the Eccentric Chuck.

If you ask me where I obtain this rule from, I answer, that the rule is deduced from the nature of all the Ellipses produced by the Elliptical Cutting-frame, or by Double-counting. For every Ellipse is a compound figure obtained by a certain *radius*, which would produce a circle, did not a certain eccentricity (aided by double-counting, or a set of change wheels) force the figure to assume the form of a true ellipse, as I have shown in Figures 1 and 2, page 6.

Now the rule to find this radius is as follows,—

The sum of the major and minor axes divided by 4 is equal to the *radius*.

And the rule to find the eccentricity is as follows,—

The difference between the major and minor axes divided by 4 is equal to the eccentricity.

And I apply the second portion of the rule to procure the eccentricity required for their borders, by assuming that their exterior edge is a true ellipse, which it is *very nearly*, and would be wholly so but for its slightly swelled shoulders.

Let us apply these two rules to Figure 2 and Pattern 4, and see if we can discover their radius and their eccentricity.

|                |                                  |          |
|----------------|----------------------------------|----------|
|                |                                  | in. dec. |
| 1st. Figure 2. | Major Axis of Ellip. Line...     | 1·9      |
|                | Minor Axis           ,,       ,, | 1·3      |

Then the sum of  $1·9 + 1·3$  divided by 4 equal  $\frac{3·2}{4} = 8$  dec., or 8 tenths, or 8 turns forward of Slide-rest, which is correct.

Then their difference is  $1·9 - 1·3$  or  $·6$ , which divided by 4 gives dec.  $·15$ , or fifteen divisions, or 1 turn 5 divisions on the Eccentric Chuck, which is correct.

2d. Pattern 4. Pattern 4 being an Elliptical Pattern, instead of a mere elliptical line like Fig. 2, you must measure from the *inside* of the top of the pattern to the *outside* of the bottom of the pattern for the major axis, and from the inside of the pattern, at its greatest breadth on the left, to the *outside* of the right of the pattern.

|                                                              |                       |
|--------------------------------------------------------------|-----------------------|
|                                                              | in. d.                |
| Inside top of Pattern to outside bottom of Pattern . . . . . | $= 1·8 =$ Major axis. |
| Inside of Pattern on one side to outside of Pattern on other | $= 1·4 =$ Minor axis. |

Then their sum, divided by 4  $= 3·2 \div 4 = ·8$ , or 8 turns on the Slide-rest, which is correct.

And their difference  $= 1·8 - 1·4$  or  $·4$ , which divided by 4 gives  $\frac{·4}{4} = ·1$ , or 1 turn on Eccentric Chuck—which is correct, as you will see in both instances by referring to the Adjustments for Fig. 2 and Pattern 4.

*Note 12, page 38.*

The reader will perceive that I begin Group 1 in this Table at 184—10 instead of at 180—9, as in the Large Double Sea-Hedgehog; the reason is, because 184—10 is the first of the 5 single lines (of 4 to 1); and if I had begun at 180—9, I should have had 6 single lines instead of 5, which would have spoilt the regularity of the pattern.

TABLE B.

*Method of setting Lathe for the 4 Groups composing a Variegated Double Sea-Hedgehog.*

| 1st Group.    | 2d Group.   | 3d Group.   | 4th Group.  |
|---------------|-------------|-------------|-------------|
| D.P. E.C.W.   | D.P. E.C.W. | D.P. E.C.W. | D.P. E.C.W. |
| Begin 184—10  | 184—34      | 184—58      | 184—82      |
| 188—11        | 188—35      | 188—59      | 188—83      |
| 192—12        | 192—36      | 192—60      | 192—84      |
| 4—13          | 4—37        | 4—61        | 4—85        |
| 8—14          | 8—38        | 8—62        | 8—86        |
| 16—16         | 16—40       | 16—64       | 16—88       |
| 24—18         | 24—42       | 24—66       | 24—90       |
| 32—20         | 32—44       | 32—68       | 32—92       |
| 40—22         | 40—46       | 40—70       | 40—94       |
| 44—23         | 44—47       | 44—71       | 44—95       |
| 48—24         | 48—48       | 48—72       | 48—96       |
| 52—25         | 52—49       | 52—73       | 52—1        |
| 56—26         | 56—50       | 56—74       | 56—2        |
| 64—28         | 64—52       | 64—76       | 64—4        |
| 72—30         | 72—54       | 72—78       | 72—6        |
| 80—32         | 80—56       | 80—80       | 80—8        |
| 88—34         | 88—58       | 88—82       | 88—10       |
| 92—35         | 92—59       | 92—83       | 92—11       |
| 96—36         | 96—60       | 96—84       | 96—12       |
| 100—37        | 100—61      | 100—85      | 100—13      |
| End at 104—38 | 104—62      | 104—86      | 104—14      |

N.B. This Table, as well as Table A, should be copied out rough on half a sheet of paper, and kept ready for use.

*Note 13, page 41.*

I here give the Adjustments for three Double Sea-Hedgehog Patterns, because I have tried them in African thorn, and found them to be very brilliant.

*Double Sea-Hedgehog, No. 1 (no figure).*

“ All at Centre.”

---

Scale, }  
192 ; }

{ Instrument,  
{ Eccentric Cutter.

Eccentric Chuck 4 (four) turns forward.

Slide-rest..... 2 (two) turns forward.

Cutter ..... 3 (three) turns forward.

Tool, double angle,  $16^{\circ}$  or  $18^{\circ}$  ; wood *lined* finely by  $\frac{1}{2}$  divisions, or else finely polished with hard laequer or French polish.

Four Groups counted same as Large Double Sea-Hedgehog, Pattern 15. Begin D.P. 180—E.C.W. 9, &c. &c. ; but do not cut too deep, as it leaves an ugly border round. These patterns look best, *I think*, without such a border as I have given, Pattern 17.

*Double Sea-Hedgehog (Small), no figure.*

“ All at Centre.”

---

Scale, }  
192 ; }

{ Instrument,  
{ Eccentric Cutter.

Then, Eccentric Chuck  $2\frac{1}{2}$  (two and a half) turns forward.

Slide-rest.....  $1\frac{1}{4}$  (one and a quarter) turns forward.

Cutter ..... 2 (two) turns.

Four Groups same as Pattern 15 (Large Double Sea-Hedgehog).

Tool, double-angle,  $16^{\circ}$  ; cut shallow, face of wood polished.

*No. 3. Very Minute Double Sea-Hedgehog.*

(*Vide* Centre Pattern of Pattern 6, page 18.)

This exquisite little pattern is almost too small to print, but I have cut it in the centre of Pattern 6, just to show its size and general appearance.

“ All at Centre.”

---

Scale, }  
120 ; }

{ Instrument,  
{ Eccentric Cutter.

*Mind* you set Eccentric Chuck perfectly upright, with Stop in the 120 division of 120 Scale.

Then, Eccentric Chuck ...  $1\frac{1}{4}$  turns.  
 Slide-rest..... 6 divisions.  
 Cutter ..... 1 turn.

Count 5 on 120 Scale to 2 on E.C.W. for each cut, beginning as follows :—

|            |                                         |                                                |
|------------|-----------------------------------------|------------------------------------------------|
| 1st Group. | { Begin at 110—8 }<br>{ End at 70—40 }  | count for each cut 5 on D.P. to<br>2 on E.C.W. |
| 2d Group.  | { Begin at 110—32 }<br>{ End at 70—64 } | ” ” ”                                          |
| 3d Group.  | { Begin at 110—56 }<br>{ End at 70—88 } | ” ” ”                                          |
| 4th Group. | { Begin at 110—80 }<br>{ End at 70—16 } | ” ” ”                                          |

The tool should be  $16^\circ$ , the cut shallow.

*Remark.* This pattern is so minute that there is only room for alternate cuts; that is, if I had as usual employed the 192 Scale, I should have cut at 8 to 2 for each cut, as I did in cutting Pattern 17, but I thought it best to substitute the 120 Scale for the 192, for these reasons :

First. 5 divisions on the 120 Scale are exactly equal to 8 divisions on the 192 Scale ; that is, each gives 24 cuts to one revolution of the wheel: thus,  $\frac{192}{8} = 24$  and  $\frac{120}{5} = 24$ .

Secondly. Both scales being thus exactly equal, I select the 120 Scale, because the way it is numbered makes it the most easy to count by; nay, it is almost impossible to make a mistake upon it, because it is *numbered* at all the 5's and 10's, while the 8's on the 192 Scale are often only marked by dots.

I make this remark *here*, because this is the first time I have used the 120 Scale ; but when we come to the 4-Looped and Square Patterns, where the ratio on the 192 Scale is invariably 8 to 1, I shall invariably substitute the 120 Scale for it.

(For more remarks on these patterns, *vide* Note 18.)

*Note 14, page 49. "Set Cutter carefully at  $5\frac{1}{2}$  divisions."*

The reader will have observed that I often use the term, "Cutter so many *whole* turns forward," and I here say *carefully*. I, therefore, take this opportunity of explaining my meaning. In paragraph 5 of page 8, I point out to the reader that a trifling error may occur in consequence of the point of the tool being left rather more on one side than the other; and I further remark, that this error should always be *allowed for*: therefore, when I use the phrase *whole* turn, or *carefully*, I simply mean to draw your attention to this small possible error, and to remind you that it must be *allowed for* in counting the *whole turn*, or even *part* of one, as in many cases the turning forward of the Cutter is in some *exact* ratio to the turning forward of some other part of the apparatus.

*Note 15, page 63. TABLE C, for Pattern 27. 3-Looped Figure in Shells.*

This Table should be copied out on a half-sheet of note-paper, to be used when required:—

| No. | D.P.   | E.C.W. |                                     |
|-----|--------|--------|-------------------------------------|
| 1.  | 144—96 | ...    | Back of 1st Loop, middle cut.       |
| 2.  | 168—   | 4      |                                     |
| 3.  | 192—   | 8      |                                     |
| 4.  | 24—    | 12     |                                     |
| 5.  | 48—16  | ...    | Extreme point of loop nearest edge. |
| 6.  | 72—20  |        |                                     |
| 7.  | 96—24  |        |                                     |
| 8.  | 120—28 |        |                                     |
| 9.  | 144—32 | ...    | Back of 2d Loop, middle cut.        |
| 10. | 168—36 |        |                                     |
| 11. | 192—40 |        |                                     |
| 12. | 24—44  |        |                                     |
| 13. | 48—48  | ...    | Extreme point of loop nearest edge. |
| 14. | 72—52  |        |                                     |
| 15. | 96—56  |        |                                     |
| 16. | 120—60 |        |                                     |

No. D.P. E.C.W.

17. 144—64 ... Back of 3d Loop, middle cut.

18. 168—68

19. 192—72

20. 24—76

21. 48—80 ... Extreme point of loop nearest edge.

22. 72—84

23. 96—88

24. 120—92 ... The next cut to this is 144—96, which you have already cut, but if you have to go round again, always set Lathc at 144—96 before you alter the Cutter, Slide-rest, or any part of the apparatus.

*Note 16, page 75.*

In order to try this accurately, I put a piece of wood in the Eccentric Chuck, and having faced it, proceeded as follows.

“All at Centre.”

Scale, }  
192; }

{ Instrument,  
{ Eccentric Cutter.

1st. I turned forward Eccentric Chuck *alone* 8 turns; I then cut 32 cuts at 6 to 1; and found that I produced one-third of a *circular*, or nearly *circular* pattern.

2d. I now turned forward Slide-rest 3 turns, and cut 32 cuts at 6 to 1, and found that I had produced one side of a 3-sided figure, and this one side was *concave*.

3d. I then turned back Slide-rest till it stood at 2 turns 2 (two) divisions, and cut 32 cuts at 6 to 1, and found that I produced one side of a 3-sided figure, which was perfectly straight (except, of course, close to the angles).

Hence, a ratio of 8 to 0 produced a circular figure.

„ 8 to 3 „ a figure with concave sides.

„ 8 to 2·2 „ a triangle with straight sides,

thus bearing out the assertion made at page 75.

*Note 17, page 97. TABLE D, for Cutting Squares in Shells,  
at 20 to 4.*

| D.P. E.C.W.             | D.P. E.C.W.             | D.P. E.C.W.  |
|-------------------------|-------------------------|--------------|
| 90—96 centre cut, side. | 10—32                   | 50—64        |
| 110— 4                  | 30—36 angle.            | 70—68        |
| 10— 8                   | 50—40                   | 90—72 side.  |
| 30—12 angle.            | 70—44                   | 110—76       |
| 50—16                   | 90—48 centre cut, side. | 10—80        |
| 70—20                   | 110—52                  | 30—84 angle. |
| 90—24 centre cut, side. | 10—56                   | 50—88        |
| 110—28                  | 30—60 angle.            | 70—92        |
|                         |                         | 90—96 again. |

*Note 18 (referred to at end of Note 13).*

The reader will find (if he will take the trouble to try) that these Sea-Hedgehogs *can* be produced, like the earlier patterns, by turning forward the Slide-rest *more* than the Eccentric Chuck, —a fact which I had not ascertained by actual experiment when I wrote this part of the work. For instance, Fig. 13 can be equally well worked by interchanging the amount turned forward on the Eccentric Chuck and Slide-rest. Thus,—

I worked mine with Eccentric Chuck 5 turns and Slide-rest  $2\frac{1}{2}$  turns forward, and I find it can be worked with Slide-rest 5 turns and Eccentric Chuck  $2\frac{1}{2}$  turns forward, the only result of the change being, that the pattern works round from the *left* instead of from the *right*. I have not, however, made any alteration in the book: first, because it is well that you should know that there are two ways of executing these patterns; secondly, because if you feel inclined to employ your time in *inventing* patterns, it is essential that you should know that in this instance (as in many other ones) such an interchange of eccentricities *does not produce a new pattern*; and thirdly, because, in consequence of the “*swelled shoulders*” of these patterns, a border executed as laid down in Note 11 *fits much closer* than one worked out by simply turning forward the Slide-rest, as laid down for those cases in which the Slide-rest is turned forward *more* than the Eccentric Chuck.

Indeed, while it would be wrong in me to omit a notice which applies in some measure to all the patterns executed by Double-counting, the reader will, I hope, perceive how little reason there really is to alter my method for the production of Sea-Hedgehogs, inasmuch as it serves, not only to produce perfect patterns, but also to introduce to the reader's notice rules for the measurement of ellipses, which are applicable to a very wide range of patterns, and are especially useful when you require to copy the works of others.

THE END.

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LONDON :

Printed by G. BARCLAY, Castle St. Leicester Sq.







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